FACTORS THAT ARE ASSOCIATED WITH PHYSICAL ACTIVITY AMONG VISITORS TO URBAN NATIONAL PARKS: ARE THERE GROUP DIFFERENCES?

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DEDICATION

To my grandmother,

Isabel Perez Woods,

and cousin,

Joshua James Jackson.

Sana, sana,

colita de rana,

Si no sanas hoy,

sanarás mañana.

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ABSTRACT

Factors That Are Associated With Physical Activity Among Visitors To Urban National Parks: Are There Group Differences?

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Research results indicate that optimal levels of physical activity (PA) yield a wide variety of beneficial health outcomes. There are, however, marked disparities between racial/ethnic groups in meeting the Centers for Disease Control and Prevention's (CDC) recommended levels of moderate-to-vigorous physical activity (MVPA). Urban national parks, especially those near communities of color, offer opportunities to encourage MVPA among their visitors. Nonetheless, research to identify facilitators and barriers to PA in these settings is limited and warrants further investigation. We aimed to identify psychosocial factors (e.g. self-efficacy, self-regulation, outcome expectancies, and social support) and perceived characteristics of a park (i.e. the social and physical environment) that are associated with an active park visit. Additionally, this investigation determined if the likelihood of an active visit was associated with visitor sociodemographic characteristics (e.g. race/ethnicity or age), group composition and weather. Starting in May and continuing through September of 2014, 1,099 adult visitors to three urban national parks in Washington D.C completed a self-administered survey to assess PA and related factors during their park visit. Accelerometer measures provided validation of the PA self-reports for approximately 10% of survey respondents (n=100). The majority of

participants (60%) identified as racial/ethnic minorities, mainly comprised of African Americans (45%). While 78% (n=849) of visitors indicated that they participated in PA during their visit, only 53% (n= 575) reported engaging in enough PA to substantially contribute to national PA recommendations. Accelerometer measurements verified that visitors who reported engaging in an active park visit took more steps, traveled longer distances, and participated in more MVPA minutes than those who reported a non-active visit. Logistic regression models found that the following sociodemographic factors were associated with PA: having a higher income, having driven to the park, coming to the park during early morning hours, reporting higher levels of general health, not being married, and not being part of a visitor group with children, a partner, or other members. After introducing psychosocial variables into the model, we found self-regulation and self-efficacy to be strongly associated with PA. Our findings indicate that several sociodemographic and psychosocial factors were significantly related to physical activity during urban national park visits. Social and behavioral concepts are important to consider when promoting park-based PA and reaching out to diverse visitor populations.

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CHAPTER 1: INTRODUCTION & BACKGROUND

PHYSICAL ACTIVITY

Obtaining an optimal combination of intensity and duration of physical activity (PA) contributes to a variety of beneficial health outcomes by preventing and controlling disease and disability. Research indicates that active adults, compared to their less active counterparts, have lower rates of all-cause mortality, high blood pressure, type 2 diabetes, coronary heart disease, stroke and multiple types of cancers (84). Even one hour of moderate-intensity PA per week is associated with lower risks of coronary heart disease and all-cause mortality (84). While activity-related injuries are common, they are generally mild and the benefit of regular activity has been shown to greatly outweigh such risks (84; 116).

However, limited data exist on the role of PA in health promotion and disease prevention among racial/ethnic minorities. Many investigations include only non-Hispanic Whites or have very small sub-samples of racial/ethnic participants, inhibiting meaningful statistical comparisons between groups (84). The CDC's most recent estimates of PA (see Table 1) indicate that African Americans are less likely to participate in 150 minutes or more of aerobic physical activity[1] than Whites (28). Whites were the only racial/ethnic group to meet the *Healthy People 2010* target of 50% of adults engaging in regular moderate or vigorous physical activity. When comparing this data to PA objectives in *Healthy People 2020,* Whites are the only group that already meet this goal (53). While the proportion of both African Americans and Whites meeting recommended PA levels was better in Washington, D.C. (49.6% and 66.4%, respectfully)

[1] 150 minutes or more of moderate-intensity or 75 minutes of vigorous-intensity physical activity per week is the CDC's recommended level of PA for adults 27. Centers for Disease Control and Prevention. 2013. *How much physical activity do adults need?* http://www.cdc.gov/physicalactivity/everyone/guidelines/adults.html#Aerobic

than the national average (43.8% and 53.6%, respectfully), local racial/ethnic disparities were worse (a 16.8% difference in Washington, D.C. and a 9.8% difference at the national level; 28).

A study by Marshall and colleagues (67) also demonstrates this disparity by finding that African Americans have higher levels of leisure-time inactivity than their White counterparts. Validated data (through the use of accelerometers) from the 2003-2004 and 2005-2006 National Health and Nutrition Examination Survey (NHANES) support this observation (44). Table 1 describes self-reported levels of PA by race/ethnicity (White, African American, Hispanic, Other and Multiracial) at the national level, as well as Washington, D.C. (24; 28).

Table 1: Percentages Participating in 150 minutes or more of aerobic physical activity per week in 2013: National Average and Washington, D.C. (28)

Location	Participation	Race				
		White	African American	Hispanic	Other	Multiracial
Nationwide Median %	**Yes # States**	**53.6** 52	**43.8** 40	**43.7** 50	**49.0** 51	**52.6** 45
	No # States	**46.4** 52	**56.2** 40	**56.3** 50	**51.0** 51	**47.5** 45
Washington, D.C. Median %	**Yes CI n**	**66.4** (62.9-70.0) 1396	**49.6** (45.9-53.4) 882	**57.2** (45.9-68.4) 91	**60.5** (48.3-72.7) 85	**58.3** (40.1-76.4) 40
	No CI n	**33.6** (30.0-37.2) 612	**50.4** (46.6-54.1) 905	**42.8** (31.6-54.1) 63	**39.5** (27.3-51.8) 52	**41.8** (23.6-59.9) 27

HEALTH IMPLICATIONS

A well-understood intermediary risk factor between physical inactivity and chronic disease is being overweight/obese (115). The burden of this condition is particularly high within the African American community. According to the National

Center for Health Statistics data from 2009 to 2012 (74), 57.5% of African American women and 38.1% of African American men 20 years old and over were obese (BMI ≥ 30.0, age-adjusted). In forty-one states and the District of Columbia, more than 30% of African American adults are obese (102); only in four states (Kentucky, Mississippi, Tennessee and West Virginia) do Whites and Africans Americans have a similar rate of obesity, indicating the weight disparity along racial/ethnic lines across most of the country (102).

It is not surprising, given these observations, that African Americans have an increased risk of developing diseases associated with obesity and lower physical activity levels. Compared to Whites, African Americans are more likely to have diabetes (74), hypertension (26; 74) and a severe or disabling stroke (74; 80). They are also more likely to die from cerebrovascular and cardiovascular diseases, as well as complications from diabetes (74; 91). Among cancers linked to physical inactivity, African Americans have a greater risk than Whites of dying from malignancies of the colon, rectum and prostate (4; 33; 94).

THEORETICAL FRAMEWORK

Given the racial/ethnic disparities in PA and PA-related health risks described above, we assessed how certain facilitators and barriers may be associated with PA. Facilitators are factors that are positively associated with a behavior (i.e. physical activity), while barriers are factors that have a negative association. This terminology is commonly used by researchers that examine health behavior (10). Other fields may use the terms “motivators” or “positive determinants/correlates” for facilitators and “constraints” or “negative determinants/correlates” for barriers. According to Glanz and

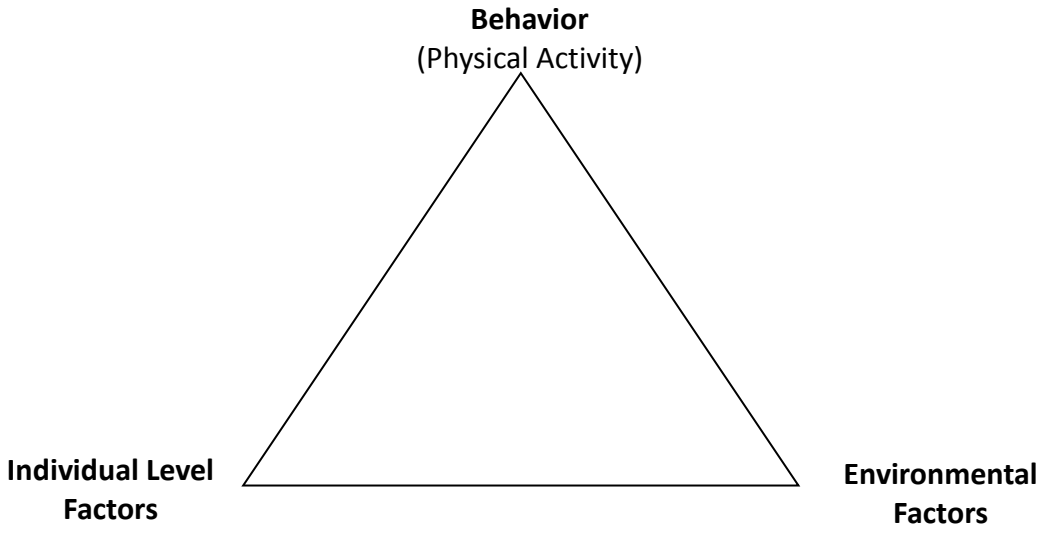
Rimer (42), social and behavioral theories can effectively contribute to health promotion efforts by providing a systematic approach to understanding behaviors and associated contextual factors (i.e. intrapersonal, interpersonal, community, and institutional).

Glanz and Rimer also suggest that the appropriateness of a chosen theory depends on whether its assumptions of the specific health issue, behavior, population and environment are: logical, in line with everyday observations, similar to those used in successful interventions, and supported by previous investigations in similar content areas under study (42). In our study, we used the Social Cognitive Theory (SCT), described in the next section, to frame our assessment of physical activity in urban national parks. The SCT has been extensively utilized in the physical activity literature (118), and provides a framework for understanding factors that influence behavior on different socio-ecological levels (versus others, such as the Health Belief Model or the Theory of Planned Behavior, which solely operate at the intrapersonal level). Understanding the relationship of higher level factors, such as perceptions of environment, with physical activity is particularly important when investigating the ability of specific settings like parks to influence the behavior of target populations.

Social Cognitive Theory

Social Cognitive Theory (8) describes the reciprocal influence of behavior, the environment and individual level factors upon each other. This relationship is called reciprocal determinism (see Figure 1).

Figure 1: Reciprocal Determinism



SCT posits that the main factors that influence behavior are self-efficacy, goals (which we measure through self-regulation) and outcome expectancies (8). The next sections define each of these constructs and describes how they have been found to be associated with PA. Several other individual-level (e.g. knowledge, social support, various health indicators and sociodemographics) and environmental (perceived physical and social environment, and weather) factors have been found to be associated with PA in the literature (1; 2; 5; 8; 13; 16; 17; 21; 37; 38; 40; 47; 48; 52; 54; 61; 65; 66; 83; 88; 89; 99; 103; 108; 111; 113; 115). These associations were identified from studies that looked at PA differences among various ethnic/racial groups, as well as those examining active and sedentary African American populations (i.e., within-group comparisons).

Individual Level Factors

Self-Efficacy. Self-efficacy describes one's confidence in being able to take action and overcome barriers (8). At least two prior investigations found that self-efficacy significantly contributed to both objectively measured (step counters and PA logs; 5) and self-reported (65) physical activity among African American and White church goers.

These findings are in line with a review by Eyler and colleagues (38) that found self-efficacy to be an important predictor of PA level among White, African American, Latina and Native American women in several living environments, including urban settings.

Self-Regulation. Karoly (59) defines self-regulation as the "processes, internal and/or transactional, that enable an individual to guide his/her goal-directed activities over time and across changing circumstances (contexts)." Anderson and colleagues (5), as well as Li and colleagues (65), both found self-regulation to be a highly influential predictor of PA.

Outcome Expectancies. Outcome expectancies are "anticipated outcomes of a behavior" (42) and are in line with a "hedonic" principle in behavioral research that suggests individuals are more likely to perform a behavior if positive outcomes are maximized and negative outcomes are minimized (12). While outcome expectancies were not found to be significantly associated with PA in Anderson and colleagues' investigation of predominantly White participants (5), they were in Li and colleagues' study of all African American participants (65). Though there may be several reasons for this difference (the use of different items to measure this construct, for instance), there may a potential racial/ethnic difference that warrants further exploration.

Social Support. Social support is defined by Gottlieb (45) as the "process of interaction in relationships which improves coping, esteem, belonging, and competence through actual or perceived exchanges of physical or psychosocial resources." There is substantial evidence linking this construct to physical activity. In a review by Eyler and colleagues (37) of 91 studies that investigated correlates of PA among women from diverse racial/ethnic groups, social support was found to be positively associated with PA

among all groups of women. Among the ways that social support has been measured in the context of PA, its association with the following factors was found to be statistically significant ($p<0.05$): being a member of a community group (89) or a religious organization (17; 38), having a partner (89) and having children in the household (13; 16; 37; 40; 47; 99; 108). Both Anderson and colleagues (5) and Li and colleagues (65) also found social support, mediated by self-efficacy and self-regulation in structural equation models, to be indirectly related to PA.

Health Indicators. In addition, several health-related indicators have been found to be associated with physical activity. These include having a higher general health status (83; 111), a normal body mass index (BMI; 17; 113; 115) and not having a chronic illness (17; 88).

Sociodemographics. The non-park literature indicates that select sociodemographic factors are statistically significantly associated with adult PA (see Table 2). They include: age, educational level, income, gender, marital status, employment status and number of children in the household. Those who are younger, more educated, have a higher income, male, married and employed tend to be more physically active.

Table 2: Sociodemographic factors statistically significantly associated with PA (>0.05)

Variable	Study
Age	(1; 2; 5; 37; 38; 54; 61; 65)
Educational Level	(1; 2; 17; 37; 48; 66; 111)
Income	(1; 17; 66)
Gender	(5; 54; 65)
Marital Status	(1; 2; 66)
Employment Status	(17; 66)
Number of Children in the Household	(13; 16; 37; 40; 47; 99; 108)

Environmental Factors

Environmental factors, as Bandura (8) describes, can be perceived or actual (e.g. perception of a safe place versus actual safety informed by crime reports). Perception of the environment is a social construction, a concept explained by Lakey and Cohen's statement, "perceptions about the world do not [always] reflect ultimate reality" (63) Therefore, PA may be associated with underlying socio-cultural perspectives (e.g. differing views of what is safe, clean or aesthetically pleasing). Understanding these perspectives can inform solutions to increased PA among racial/ethnic subpopulations.

Physical Environment. A review by Humpel and colleagues (52) reported that several studies found accessibility, opportunities for activity and aesthetic attributes of the natural and built environment to be significantly associated with PA levels. Li and colleagues (65) also found perceived physical environment to significantly predict PA among their sample of African Americans.

Social Environment. The perceived social environment, or the cultural and social atmosphere of an area used for PA, is another environmental-level factor that has been found to be associated with PA. Examples of such factors that have been studied in other investigations include: a perceived lack of safety (21; 113), crowding (113), feeling unwelcome (113), availability of activities that individuals' want (113), a fear of racial/ethnic conflict (113) and the presence of dogs off their leash (61).

Weather. Weather has also been found to be associated with PA. A review by Tucker and Gilliland (103) found, among 37 studies in 8 different countries, poor or extreme weather serves as a barrier to moderate levels of PA.

URBAN PARKS AS A SOLUTION

This investigation focused on urban park settings for several reasons. Outside of the South, most African Americans live in metropolitan statistical areas (105). This suggests that urban parks are well-situated locations to investigate PA among African Americans; further study may highlight how these parks could address PA disparities among this subgroup. They are also generally free or low cost to enter and offer spaces for a variety of physical activities. The availability of urban parks, a growing collaborative interest among urban planners, leisure scientists and public health researchers (20), has also been linked to increased PA among adult community members (32).

In their conceptual model, Bedimo-Rung and colleagues (14) hypothesize how parks are related to public health. Similar to SCT, this model positions visitor characteristics (individual and social factors) and park characteristics (park features, conditions, access, esthetics, safety and policies) as determinants (which we call facilitators and barriers) to both individual visitation and PA within a park. An advantage of identifying environmental factors that impact individuals' PA, which are often beyond the control of the individual, is that they are potentially modifiable by the public health and park sectors (14).

Furthermore, recreational visits to parks have been shown to be associated with physical activity and improved visitor wellbeing (14; 30). Several health indicators have also been linked to park and trail use (113), including: lower Body Mass Index (BMI), blood pressure and fewer physician visits (82).

The National Park Service (NPS) has recognized the potential for advancing public health through park use. Their program, *Healthy Parks, Healthy People* (75),

highlights the need for “activities that contribute to physical, mental and spiritual health, and social well-being” and “equitable access to open spaces and natural places” (78). This research is consistent with the National Park Service’s mission to promote health and active living among the Nation’s citizens.

Active Park Visit

Study findings suggest park visitors may not enjoy physical health benefits without a sufficiently active park visit (19; 39). Although the park sector also emphasizes visits that promote relaxation and general mental health (19), this study limited its focus to activities that would be expected to influence physical health.

To our knowledge, there is no standard definition for an active park visit in the literature. Buchner and Gobster (2007) propose that an active visit should include at least 30 minutes of moderately intense activity or 20 minutes of vigorously intense activity. This approach corresponds with the 2008 Physical Activity Guidelines Advisory Committee recommendations for physical activity among adults (84), which calls for at least 30 minutes of moderately intense activity per day, 5 times a week or 20 minutes of vigorously intense activity per day, 3 times a week. The CDC, which previously recommended these levels for adults, has since updated their adult PA recommendations to engage in 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity per week (27). Moderate intensity is defined by the CDC as doing any physical movement rather than sitting that causes small increases in breathing or heart rate such as brisk walking, bicycling or playing with kids or a dog (27). Vigorous intensity is defined as doing any physical movement that causes large increases in breathing or heart rate such as running, aerobics or participating in a sports event like soccer (27).

GAPS IN THE SCIENTIFIC LITERATURE

As noted above, several studies have examined facilitators and barriers associated with PA in various settings. Few, however, have focused specifically on which factors are associated with adult PA within parks, especially those that serve diverse communities (30; 34; 39; 50; 57; 69; 73; 95; 113). This knowledge highlights a particular need since barriers to recreation and active living are thought to be perceived differently across racial/ethnic lines (31; 41; 56; 92; 93; 98; 113).

The majority of investigations that have studied factors associated with PA among park visitors have either been qualitative in nature (50) or drawn from samples that included very few African Americans (73; 83; 95; 113). To our knowledge, only one study has applied statistical analyses to examine this topic by race/ethnicity (113). That study's sample, however, included only a small proportion (5%) of African American participants. Table 3 presents a summary of prior studies on facilitators and barriers to PA in parks.

Table 3: Summary of studies on facilitators and barriers to PA in parks

Author (Year)	Park Type	Population Sample (N)	Research Methods
Henderson, Neff, Sharpe, Greany, Royce & Ainsworth (2001)	Suburban Community	52 participants (6 groups: women's walking group, teacher and school employees, YMCA members and employees, Chamber of Commerce business group, a Community Coalition for Physical Activity group and participants in senior services) in a southeast U.S. community; 46% African American and 54% European American	Focus groups that assessed perceptions about quality of life in the community and the PA opportunities available to participants, their friends and family. Constraints and barriers to participation were also addressed

Son, Mowen & Kersetter (2008)	Urban Community	271 volunteers and visitors over 50 years old in a Midwest metropolitan park agency (convenience sample at 3 park visitor centers, a volunteer meeting and 2 special events for the public); 96% White, no other racial/ethnic data reported	Self-administered survey that tested a modified version of a leisure constraint scale. Variables included PA participation, a constraint scale (intrapersonal, interpersonal, structural), a negotiation scale (time management, skill acquisition, interpersonal coordination, financial) and motivation (enjoyment motive and health motive)
Mowen, Trauntvein, Graefe & Son (2012)	State	1,139 park visitors in 6 Pennsylvania state parks; race/ethnicity not reported due to "insufficient diversity in sample"	Onsite interviews measuring demographics (e.g. age, income), behaviors (e.g. use frequency, park activity types) and experience preferences (e.g. nature connection, physical fitness, social relationships)
Payne, Orsega-Smith, Godbey & Roy (2005)	Urban Community	1,515 adult respondents over 50 years old in Cleveland, OH; 88.7% White, no other racial/ethnic data reported	Self-administered survey that measured perceived physical and mental health, general PA, park use, logistics of

			park use, park benefits and demographics. Participants were approached in parks, grocery stores, shopping malls and senior centers
Wilhelm Stanis, Schneider, Chavez & Shinew (2009)	Urban Community and Non-Urban Community	1,296 park visitors in 4 parks (2 urban proximate, 2 urban distant) in Los Angeles, CA and Minneapolis, MN; 5.1% African American, 50.7% White, 38% Hispanic/Latino, 3.1% Asian	Onsite self-administered survey that measured demographics (e.g. age, race/ethnicity), general PA (intensity, type, location of usual PA) and constraints to PA in a park (e.g. not enough time, family obligations, etc)

In addition to these gaps in the literature, instruments that assess general (i.e. non-park specific) PA are not ideally designed to measure park-based PA for two reasons. First, they tend to assess PA taking place in multiple environments (the home, the workplace, leisure activities), making them difficult to directly adapt to assessment of park-based PA. If done, any validation of the instrument would likely diminish. Second, they commonly assess PA over several days (i.e. recall of the last seven days, or the last month) versus same-day activity. While instruments have been developed to measure park-based PA (73; 109; 113), none, to our knowledge, have been directly validated. Only one questionnaire, The Physical Activity in the Park Setting (PA-PS) Questionnaire, found minutes being physically active in the park, (1 item; Spearman's r=.46) and

activity type (numerous items assessing specific park activities; Kappa=0.21 to 0.90), to have fair to substantial test-retest reliability among Californian residents (109). This lack of known psychometric rigor is an additional limitation to the existing literature in this area.

This study advances our understanding of factors related to physical activity in the following ways:

- We sampled from parks that are proximal to communities with a large proportion of African American adults to yield sufficient statistical power to explore differences between racial/ethnic groups. We are unaware of any published studies examining factors associated with park-based PA with more than ~ 5% of their total sample being African American.
- No studies examining racial/ethnic differences in PA have been carried out in national parks. The National Park Service has expressed a need for more information on increasing physically active park visits, particularly among racial/ethnic minority group members. This means that our findings are likely to be applied to improved services and/or programs that have the potential to influence health disparities.

SPECIFIC AIMS

The intended outcome of this study was to understand factors (facilitators and barriers) associated with increased PA in urban national parks so that our ability to increase PA levels among diverse adults from sociodemographic subgroups would be improved. We aimed to advance scientific knowledge towards this end by conducting, analyzing, and interpreting a survey and comparing accelerometer validation data from

adult visitors to three urban national parks in Washington, D.C. The specific aims of this study were to:

Specific Aim 1: Determine the proportion of visitors to urban national parks who reported engaging in a physically active visit (engaging in moderate-intensity activity for 30 minutes or longer, or vigorous-intensity activity for 20 minutes or longer).

Specific Aim 2: Determine if the proportion of visitors to urban national parks who reported engaging in a physically active visit differs by visitor sociodemographic characteristics (e.g. other race/ethnicity groups, gender, age, educational level, income, etc.).

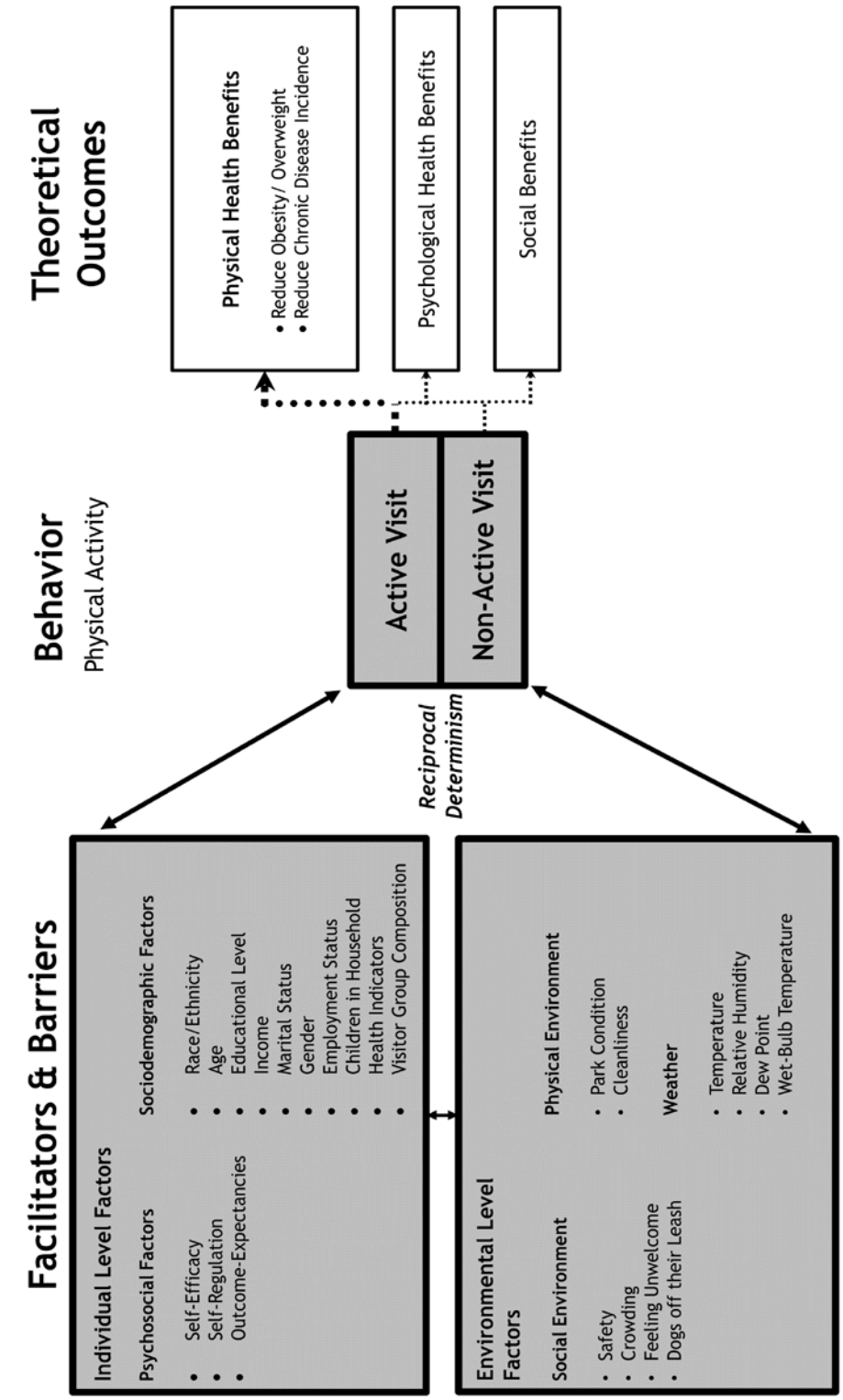
Specific Aim 3: Assess psychosocial and environmental factors associated with a reported physically active visit to urban national parks.

CONCEPTUAL MODEL

Our conceptual model (Figure 2) illustrates the conjectured relationship between facilitators and barriers to an active park visit and public health. The shaded boxes (under the "Facilitators and Barriers" and "Behavior" headers) represent the primary factors under investigation in our study. The constructs, under the "Facilitators and Barriers" header, are grouped by individual level (psychosocial factors and sociodemographics) and environmental level (physical environment, social environment and weather) factors. These constructs were either informed by Social Cognitive Theory (8), social-ecological models (14; 65) or were found to be significantly associated with physical activity in studies that examined diverse racial/ethnic groups in general settings, or relatively homogeneous groups in park settings.

While both active and inactive visits may theoretically contribute to psychological and social benefits (dotted lines), we posit, based on evidence from the literature, that only an active park visit will contribute positively to physical health benefits (bolded dotted lines).

Figure 2: Conceptual Model



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CHAPTER 2: MANUSCRIPT 1

SOCIODEMOGRAPHIC FACTORS ASSOCIATED WITH PHYSICAL ACTIVITY AMONG VISITORS TO URBAN NATIONAL PARKS[2]

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ABSTRACT:

Research indicates that a wide variety of beneficial health outcomes occur from increased intensity and/or duration of physical activity. Marked racial/ethnic disparities have been reported in meeting the Center for Disease Control and Prevention's (CDC) guidelines for recommended levels of moderate-to-vigorous physical activity (MVPA), particularly for African Americans. Urban national parks, especially those near communities of color, are well positioned to encourage MVPA among their visitors. Nonetheless, research of park-based physical activity among diverse groups of visitors has been limited. In this study, 1099 adult visitors to three urban national park sites in Washington, D.C. completed a self-administered survey between May and September 2014. For approximately 10% of the sample (n=100), accelerometers were used to validate self-reports of physical activity. More than half of the participants in our sample were members of racial/ethnic minority groups (n= 639), mainly African Americans (n= 493). While 78% (n= 849) of visitors indicated that they were somewhat active during their visit, only 53% (n= 575) reported activity that substantially contributes to weekly MVPA levels recommended by the CDC. Multivariate logistic regression was used to determine which sociodemographic factors were associated with engaging in an active park visit. Having a higher income, reporting higher levels of general health, having driven to the park, and arriving in the park during early morning hours were all significantly associated with increased physical activity. Being married or being part of a visitor group with children, a partner, or other family members were associated with decreased physical activity. Among the subset of visitors who wore an accelerometer, those who reported engaging in an active park visit took significantly more steps, traveled longer differences and spent more time engaging in MVPA than visitors who reported a non-active visit.

Our findings suggest that there is opportunity to promote physical activity among population subgroups in urban national parks and inform public health practitioners and park management of outreach opportunities.

KEYWORDS:

Physical activity, health behavior, national parks, minority health, survey, accelerometer, sociodemographic factors

DISCLAIMER:

The Views expressed are those of the authors and do not necessarily reflect the official views of the Uniformed Services University of the Health Sciences or the United States' Department of Defense.

INTRODUCTION

Evidence suggests that physically active adults have lower rates of all-cause mortality, high blood pressure, type 2 diabetes, coronary heart disease, stroke and multiple types of cancers than their less active counterparts (84). Limited data exist, however, on the role of physical activity in health promotion and disease prevention among sociodemographic sub-groups (79; 84). The Center for Disease Control and Prevention's (CDC) most recent estimates of physical activity from the 2013 Behavioral Risk Factor Surveillance Survey indicate that the proportion of African Americans (43.8%) and Latinos/Hispanics (43.7%) who participate in the recommended levels of aerobic physical activity, 150 minutes per week, is lower than Whites (53.6%) (28). Since the relationship between race/ethnicity and physical activity can be confounded by other sociodemographic factors, it is important to also investigate the effect of these factors when examining physical activity among population subgroups (114).

Understanding the sociodemographic factors associated with physical activity in unique settings may help facilitate successful health promotion efforts among diverse populations. In particular, urban parks are well-suited locations for study of sociodemographic factors and physical activity due to the high representation of communities of color (e.g., communities with high proportions of African Americans or Hispanics/Latinos) in metropolitan statistical areas (106). Public parks are also free or

low cost to enter and may offer different areas for a variety of physical activities. While several studies have examined facilitators and barriers associated with physical activity in various settings, few focused specifically on factors associated with physical activity in urban parks, especially parks that serve diverse communities (30; 39; 50; 73; 95; 113). The U.S. National Park Service, through its *Healthy Parks, Healthy People* initiative, has recognized the potential for advancing public health through park use and has advocated for better understanding of the needs of diverse park visitors (76).

Since park visitors may not enjoy physical health benefits without a sufficient level of physical activity, there is a need to understand which factors are related to being more or less active during a park visit (19; 39). Investigations in non-park settings have found several factors to be associated with physical activity, including: being younger, having a lower BMI, having a higher educational level, having a higher income, being male, being White, being married, being employed, having children in the household, having a higher general health status, not having a chronic illness, and experiencing fair weather conditions (1; 2; 5; 13; 16; 17; 36; 37; 40; 44; 47; 48; 53; 54; 61; 65-67; 83; 99; 100; 103; 108; 111-113; 115). To our knowledge, previous investigations that studied factors associated with physical activity among park visitors were qualitative in nature or had inadequate diversity for statistical comparisons between African Americans and other racial/ethnic groups (50; 73; 83; 95; 113).

METHODS

Study Design

Using a cross-sectional design, adult visitors to three urban national parks in Washington, D.C. completed a self-administered survey from May to September 2014.

To yield sufficient numbers of participants from diverse subgroups, geospatial analysis (ArcGIS Desktop 10) was used to select parks proximal to neighborhoods with large concentrations of racial/ethnic minorities (35; 77; 104). Two parks (A and B) were located within a half of mile of census tracts comprised of 95% African Americans, a distance found to be associated with increased park use (29; 30; 97). The third park (C) was located within a half mile of several census tracts primarily comprised of White, African American and Hispanic/Latino residents.

Participant Recruitment

Within each park, two recruitment locations were selected based on factors intended to reduce the likelihood of selection bias. These factors included an examination of the number of visitors who utilized the space, the sites' proximity to different types of activity areas, and proximity to multiple transportation options (e.g., vehicle parking lots, walkways, metro stations and/or bus stops). Recruitment occurred on 51 weekdays and 24 weekend days between May 6, 2014 and September 16, 2014. To capture visitors throughout the day, recruitment shifts were 9am-3pm or 2:30pm-8:30pm.

Survey participants were recruited at the end of their visit as they exited the park. If visitors were part of a group, a random adult was selected to participate using the most recent birthday method (64). In the event that multiple visitors or groups were leaving at the same time, a data collector visually scanned the recruitment area and selected the visitor to the farthest left, then the visitor in the middle (second occurrence) and finally the visitor to the farthest right (third occurrence). A waiver of signed informed consent was obtained from the Uniformed Services University of the Health Sciences' institutional review board. An approved standardized verbal introduction and study

information sheet was provided to all potential participants. Surveys were administered on Android™ devices using Kobo Toolbox, an electronic data collection system based on Open Data Kit (ODK) (18). After completing their survey, visitors were offered a bottle of water as a token of appreciation.

Measurement Tool

The survey included items that examined the main outcome of interest, park-based physical activity, and several independent variables. Draft survey items and response options were evaluated with five cognitive interviews, a pre-testing technique known to reduce reporting error (55).

Park-Based Physical Activity

We adopted the approach of Buchner and Gobster to operationalize our main outcome of interest: a sufficiently active park visit (19). We defined an active visit as one including participation in at least 30 minutes of moderately intense activity or 20 minutes of vigorously intense activity for at least 10 minutes at a time. This definition allows us to evaluate how park visits contribute to recommended weekly levels of physical activity published in the 2008 Physical Activity Guidelines Advisory Committee Report (i.e., at least 30 minutes of moderately intense activity per day, 5 times a week or 20 minutes of vigorously intense activity per day, 3 times a week for at least 10 minutes at a time).

Physical activity items on our survey were adapted from the Physical Activity in the Park Setting (PA-PS) Questionnaire and the Physical Activity module from the 2011 Behavioral Risk Factor Surveillance Survey (BRFSS) (25; 109). Participants were first asked if they had spent any time being physically active during their park visit (yes or no). Physical activity was described as:

> By physically active we mean doing any physical movement rather than leisurely walking. Some examples include brisk walking, jogging or biking.

Those who answered yes were asked if they had engaged in any moderate-intensity activities (yes or no), if these activities lasted for at least one continuous 10-minute period (yes or no) and how many minutes their activities occurred. Vigorous-intensity activities were then assessed in a similar manner. Descriptions of each intensity level were provided beneath each relevant item and adapted from the 2008 National Health and Nutrition Examination Survey (23):

> By moderately active we mean doing any physical movement that caused SMALL increases in your breathing or heart rate. Examples would include brisk walking or playing with kids or a dog.
>
> By vigorously active we mean doing any physical movement that caused LARGE increases in your breathing or heart rate. Examples would include running or participating in a sports event like soccer.

Validation of Self-Reported Physical Activity

To assess the validity of our self-reported physical activity survey items, a sub-group of the sample (n= 100) was comprised of visitors selected to wear a New Lifestyles® NL-1000 accelerometer that objectively measured how many steps they took, how far they traveled, and how long they spent participating in activities with moderate-to-vigorous intensity during their park visit. The stride length (2’6”) and moderate-to-vigorous intensity threshold (4 to 9 activity levels) were set to default levels for all participants. Data collectors approached visitors on 14 days from May-August 2014 as they first entered the park using similar recruitment and informed consent methods

previously described. Potential participants were excluded if they had planned to be immersed in water, would be in the park later than data collectors, planned to use a different exit when they left the park, or were less than 18 years old. Eligible participants were instructed to wear the accelerometer on their left hip during their entire visit and return to the same recruitment site before they exited the park. Once they returned, participants were given the same survey instrument as the rest of the larger sample. At completion, participants were given a $10 gift card and bottle of water.

Independent Variables

We assessed mode of transportation to the park (i.e., car, bus, metro, biked, walked, ran/jogged, and other) with one question. Five questions on group characteristics assessed whether participants were with anyone in the park during their visit. If they were, participants were prompted with items that inquired about the composition of their group by different classification categories (i.e., partner, other family members, friends, community group, and/or other) and age group (i.e., with other adults, children, or both adults and children), as well as the number of visitors with them in each age group. A partner was defined as a spouse, boyfriend/girlfriend, or significant other.

Sociodemographic items were adapted from the 2011 BRFSS questionnaire (25). These items included age, gender, Hispanic/Latino status (yes or no), race, height, weight, general health status, chronic illness status, educational level, household income, marital status, two items on the number of children in their household (if they answered yes to the first item, we asked how many children), and employment status.

Objective measurement of temperature, relative humidity, dew point and wet-bulb temperature were recorded using the Pyle© PTHM15 temperature and humidity meter.

Measurements were taken by study staff as participants completed the survey. Park site, month, and day of the week that recruitment occurred, as well as the time that visitors reported arriving in the park, were also examined to assess their potential confounding effects on the relationship between the other independent variables and park-based physical activity.

Statistical Analysis

Electronic survey responses (with no personally identifying information) were aggregated on a cloud-based server using ODK Aggregate and imported into a Stata 13.1 database (96). Descriptive statistics (i.e., frequencies and means) were calculated for sociodemographic factors, group characteristics and park-based physical activity levels. In order to conduct logistic regression analyses to investigate the association between the independent variables and park-based physical activity, we performed several analytical steps. First, the dependent variable was coded dichotomously (0= Non-Active Visit; 1= Active Visit). We then used contingency tables to examine each of the independent variables with the dependent variable. Categories were combined or collapsed in order to guarantee adequate cell sizes for logistic regression. Each independent variable was then assessed independently with bivariate logistic regression and was included in the initial model if its p-value was less than 0.25, as suggested by Hosmer and Lemeshow (51). Potential confounders were assessed by reintroducing any previously eliminated variable into the model and assessing whether they changed the effect of other variables by at least 10%. Several interaction terms were created to assess the joint effect of variables thought to be significant based on previous literature. Independent variables in the final model were considered significant if their p-value was less than 0.05 or marginally

significant if their p-value was less than 0.10. The overall fit of the model was examined for goodness of fit (log likelihood chi-square and Hosmer-Lemeshow tests) and multicollinearity, as well as any unusual standardized Pearson residuals, deviance residuals, and influential observations. Differences in accelerometer measurements between visitors who self-reported an active and a non-active park visit were assessed using the Wilcoxon Rank-Sum test.

RESULTS

Response Rate

The overall response rate for park visitors who were only asked to complete the survey was 58.1% (999 completed survey/1719 approached for survey). We defined study completion as answering more than 80% of relevant survey items (i.e., not including items excluded due to skip patterns). One survey participant (Park A) withdrew from the study due to time constraints.

Park Visitor Characteristics

Table 3 describes the sociodemographic characteristics of the final sample, which includes participants who wore an accelerometer (n = 1099). The majority of participants reported that they were racial/ethnic minorities (58.1%), had spent at least some time in college (82.9%), had no children in their household (62.8%), and were employed for wages (67.6%). The largest proportion of participants also reported being of normal weight (41.3%), in very good or excellent health (64.7%), and having no chronic illness or ongoing condition (82%). The mean age of the sample was 41.3±0.8 years.

Park Group Characteristics (see Tables 4 & 5)

Most visitors (72.8%) used a motor vehicle to enter the park and were part of a group (69%). Of those in a group (n= 758), most came with family members (40.1%) or their partner (36.7%). More than half of these groups (54.6%) were composed of adults only. Among groups that had children (43.4%), most had one (36.8%) or two children (26.4%).

Physical Activity Levels

A large proportion of the sample (77.3%) reported spending time being physically active during their park visit (Table 6). A similar proportion (71.8%) also said they engaged in either moderate or vigorous intensity physical activity for at least one continuous 10 minute period. Roughly half of the sample (52.4%) reported engaging in an "active park visit," defined as 30 minutes or more of moderate or 20 minutes or more of vigorous intensity physical activity for a minimum of 10 minutes at a time.

Validation of Self-Reported Physical Activity

Of the 160 people who were asked to wear an accelerometer during their park visit, 62.5% agreed and completed a survey at the end of their visit (n= 100). We considered study completion as wearing the device during an entire visit and completing more than 80% of relevant survey items. Among these participants, 49% reported a non-active visit and 51% reported an active visit. Device measurements from visitors who reported an active park visit indicated that they had taken more steps (p=0.000), traveled longer distances (p=0.000), and spent more time engaging in moderate-to-vigorous physical activity (p=0.000) than visitors who reported a non-active visit (Figures 3-5).

Sociodemographic Factors Associated with Physical Activity

Univariate examination of each independent variable and its individual association with park-based physical activity is displayed in Table 7. The results of the final logistic regression model are found in Table 8. Two variables, dew point and month, did not meet cutoff criteria ($p \leq 0.25$) for inclusion in full model. Two additional variables were excluded due to their collinearity with other variables: having children in the household (collinear with having children in park group) and wet-bulb temperature (collinear with temperature).

Park visitors who reported the highest level of household income (> $200,000) were found to be much more likely than lower income individuals to report an active visit. Our two other indicators of socioeconomic status (SES), education and employment status, were not found to be associated with physical activity in the final model, even though they appeared to be significant when first examining them with univariate analysis. Before controlling for other factors, visitors were less likely to report an active visit if they had not spent any time in higher education after high school (OR= 0.65; 95% CI [0.47-0.90]) or were not employed (OR= 0.69; 95% CI [0.51-0.93]).

Being female was associated with lower odds of physical activity (OR= 0.78; 95% CI [0.62-1.00]) before controlling for other variables. Once controlled, this association became insignificant (OR= 0.88; 95% CI [0.65-1.19]). Age did not display significance in any of our models. Marital status, which was significant (OR= 1.35; 95% CI [1.06-1.72]) during univariate analysis, maintained significance when other factors were controlled. Not being married was associated with a 43% increase in odds of having an active visit (95% CI [1.02-2.01]) in the final model.

When examining group composition, visitors who came with children (OR= 0.48; 95% CI [0.32-0.74]), a partner (OR= 0.49; 95%CI [0.39-0.79]) or other family members (OR= 0.54; 95% CI [0.37-0.88]) had reduced odds of an active park visit. Mode of transportation to the park was also associated with reported physical activity. Compared to those who drove a car, visitors who arrived by foot-- whether they walked or ran--were 45% less likely to be active (95% CI [0.37-0.82]).

As visitors' reported levels of general health declined, their likelihood of reporting an active park visit dropped in a dose response fashion. Compared to those in excellent health, visitors who reported very good (OR=0.65; 95% CI [0.45-0.95]), good (OR= 0.48; 95% CI [0.31-0.74]) and fair/poor (OR= 0.22; 95% CI [0.11-0.44]) health all had lower odds of reporting an active visit. Body mass index (BMI), calculated from self-reported height and weight, was not significantly associated with an active visit in our models.

Visitors who came to the park on a weekend were more likely to be active than weekday visitors (OR= 1.51; 95% CI [1.19-1.93]). This association became insignificant in the final model (OR= 1.18; 95% CI [0.79-1.77]), however. After controlling for other factors, those who arrived in the park during the early morning hours, 5:30am-10:59am, had higher odds of an active visit than visitors who arrived in the afternoon, 11am-3:59pm (OR= 0.71; 95% CI [0.50-1.00]), and the evening, 4pm-8:30pm (OR= 0.61; 95% CI [0.39-0.98]).

When examining their individual association with physical activity, temperature and relative humidity showed significant effects. With every one degree (°F) increase in temperature, there was a 2% decrease in the odds of being active in the park (95% CI

[0.96-0.99]). Conversely, with every one degree increase in relative humidity, there was a 1% increase in the likelihood of being active (95% CI [1.00-1.02]). These associations were not significant within the multivariate model, however.

DISCUSSION

We found that while the majority of visitors reported some level of physical activity during their park visit, a smaller proportion reported engaging in enough activity to substantially contribute to national recommendations of physical activity. This indicates an opportunity for public health practitioners and park officials to promote higher levels of physical activity in urban parks.

Contrary to previous studies that reported racial/ethnic minority group members to be less physically active in parks than Whites, we did not find an association between race/ethnicity and physical activity (15; 58; 87). While this finding could be attributed to geographical differences, there are several possible explanations. First, these studies used direct observation to assign activity levels and race/ethnicity. While there are merits to examining physical activity through observation, there is insufficient evidence supporting the validity of racial/ethnic categorization through observation alone (71; 110). Misclassification of race/ethnicity could therefore account for these differences. Additionally, these investigations did not measure indicators of SES, such as income, employment status, and education, which may explain the observed racial/ethnic differences. In our investigation, we found that racial/ethnic associations with physical activity lost significance when controlling for other sociodemographic factors. This finding is in line with other studies examining physical activity with multivariate analysis

(49; 117). Visitors who reported a lower income had significantly reduced odds of reporting an active visit than those with higher income levels.

Several sociodemographic variables that were examined, in fact, appeared to be significantly associated with lower odds of being physically active before controlling for the effects of other variables (see Table 8). Such factors included being a woman, not being employed, having lower levels of education and having a higher BMI. Some of these shifts in significance could be explained by other significant findings in our study. For example, in our sample, a greater proportion of women than men indicated that they had children with them during their park visit. Since being part of a group with children during a park visit was strongly associated with being less physically active when compared to groups without children, the presence of children appears to explain, at least partially, the aforementioned gender differences seen with simple univariate analysis. Women may be more likely than men to be watching children in the park, which could serve as a barrier to physical activity. Understanding this relationship further, especially if the presence of younger versus older children has an effect on adult physical activity levels, could help us understand the need for programs that provide child care, organized activities for children during park visits, or ways for adults to exercise with children.

Three other group composition variables were found to be associated with reduced odds of an active visit: being married, with a partner, or with other family members while at the park. While some investigations have found a positive association between having a partner and physical activity, others are consistent with our results (2; 89). Visitors who come with others may utilize the park in other, non-physically active ways such as attending a picnic or family reunion. Further investigation on group

visitors' activities may shed light on why they may be less likely to have an active visit than other types of visitors.

In line with several studies that have examined general health status, we found that having a higher self-perception of general health was associated with physical activity (2; 17). With our cross-sectional study, however, the direction of this relationship cannot be assessed.

Participants who indicated that they arrived by foot were less likely to have an active visit than those who used a car. This could be due to the physical exertion from their trip to the park, and possible anticipation of a similar amount of activity after they leave. Understanding the type and intensity of physical activity that occurs to and from a park could provide additional information on how park visits contribute to a visitor's physical activity regimen. In addition, visitors who reported coming to the park during the early morning hours, between 5:30am and 10:59am, were more likely to have an active visit than those who reported arriving later in the day. This suggests that park-based physical activity programs that occur during lunchtime or afternoon hours, particularly after working hours, could better serve visitors who are more likely to have a physically inactive park visit. Since we are unaware of other investigations that have examined arrival time and park-based physical activity, future research is needed to understand the generalizability of this finding.

Finally, we were encouraged that our accelerometer findings were significantly correlated with our survey, and in the predicted direction. Self-reported physical activity instruments are seldom validated and may not display adequate levels of validity when compared to directly measured physical activity data (73; 85; 90; 101; 109; 113). Having

this additional evaluation gives us confidence that our physical activity findings were sufficiently valid.

Study Limitations

Our main outcome of interest, park-based physical activity, was measured by self-reported survey data, which is subject to recall error and social desirability bias. Even though recall error may cause misclassification, it may have been minimized in our study since we assessed setting-specific physical activity immediately after it was completed in the park. This is in contrast to other self-reported assessments that ask participants to recall general physical activity over several previous days or weeks (23; 25). Social desirability may also bias participant activity estimates, as well as reports related to income, height, and weight. We hoped to minimize this effect by using self-administered surveys, which do not require participants to directly admit sensitive information to another person.

While we recruited over several months from late spring to early fall, our results may not be generalizable to other times of the year. In addition, our focus on urban national parks within Washington D.C. may affect the generalizability of our findings in other national park settings. Since these parks were embedded within urban communities, they more closely resemble community-level parks than the large rural national parks more commonly associated with the National Park Service. Further investigation into how urban national parks are uniquely positioned to encourage physical activity and health is warranted.

CONCLUSIONS

We identified several factors that were associated with being physically active in urban national parks. Having a higher income, driving to the park, coming to the park during early morning hours and reporting higher levels of general health were factors positively associated with physical activity. Conversely, being married and being part of a visitor group with children, a partner, or other family members were associated with a reduced likelihood of experiencing an active park visit. Future investigations could utilize focus groups or other qualitative methods to increase our understanding of why some subgroups are less active when they visit urban national parks. Visitor feedback could also generate ideas that park planners might use to promote physical activity among diverse populations.

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Table 3: Park Visitor Sociodemographics

Sociodemographic Variables	Frequency (n)	Percentage (%)
Gender		
Male	569	51.77
Female	529	48.13
Missing	1	0.09
Total	1099	100
Race		
White	395	35.94
Black or African American	493	44.86
Asian	28	2.55
Hispanic or Latino (any race)	86	7.83
Multiple Race	32	2.91
Other	50	4.55
Missing	15	1.36
Total	1099	100
Age		
18-19	15	1.36
20-29	211	19.20
30-39	300	27.30
40-49	284	25.84
50-59	170	15.47
60-69	77	7.01
≥70	36	3.00
Missing	6	0.55
Total	1099	100
BMI		
Underweight (<18.5)	15	1.36
Normal Weight (18.5-24.9)	454	41.31
Overweight (25-30)	366	33.30
Obese (>30)	227	20.66
Missing	37	3.37
Total	1099	100
Education		
< High School	22	2.00
High School or GED	153	13.92
Some College	149	13.56
2-Year College Degree	53	4.82
4-Year College Degree	288	26.21
Advanced Degree	421	38.31
Missing	13	1.18
Total	1099	100
Income		

< $25,000	136	12.37
$25,000-$49,999	169	15.38
$50,000-$74,999	194	17.65
$75,000-$99,999	132	12.01
$100,000-$149,999	173	15.74
$150,000-$199,999	107	9.74
$200,000 or More	131	11.92
Missing	57	5.19
Total	1099	100
Marital Status		
Married	462	42.04
Divorced	109	9.92
Widowed	19	1.73
Separated	24	2.18
Never Married	466	42.40
Missing	19	1.73
Total	1099	100
Children ≥18 Years in Household		
0	677	61.60
1	172	15.65
2	148	13.47
≥3	81	7.37
Missing	21	1.91
Total	1099	100
Employment Status		
Employed for Wage	728	66.24
Self-Employed	141	12.83
Out of work > 1 year	37	3.37
Out of Work < 1 year	27	2.46
A Homemaker	20	1.82
A Student	65	5.91
Retired	59	5.37
Missing	22	2.00
Total	1099	100
General Health Status		
Poor	9	0.82
Fair	68	6.19
Good	310	28.21
Very Good	457	41.58
Excellent	254	23.11
Missing	1	0.09
Total	1099	100
Chronic Illness Status		
Yes	171	15.56

No	901	81.98
Not Sure	17	1.55
Missing	10	0.91
Total	1099	100

Table 4: Mode of Transport into Park

Mode of Transport	**Frequency (n)**	**Percentage (%)**
Car	800	72.79
Public Transportation	23	2.09
Bicycle	62	5.64
On Foot	205	18.65
Other	6	0.55
Missing	3	0.27
Total	1099	100

Table 5: Visitor Group Composition

Variables	Frequency (n)	Percentage (%)
Part of a Group		
Yes	758	68.97
No	340	30.94
Missing	1	0.09
Total	1099	100
With Partner in Group		
Yes	278	36.68
No	479	63.19
Missing	1	0.13
Total	758	100
With Other Family Members in Group		
Yes	304	40.11
No	453	59.76
Missing	1	0.13
Total	758	100
With Friends in Group		
Yes	240	31.66
No	517	68.21
Missing	1	0.13
Total	758	100
With Community Group		
Yes	77	10.16
No	680	89.71
Missing	1	0.13
Total	758	100
With Other Group Type		
Yes	55	7.26
No	702	92.61
Missing	1	0.13
Total	758	100
Age Category of Group		
With Adults Only (≥18 years)	414	54.62
With Children Only (<18 years)	146	19.26
With Both Adults and Children	183	24.14
Missing	15	1.98
Total	758	100
# of Other Adults in Group		
1	311	52.45
2	83	14

≥3	199	33.56
Missing	4	
Total	597	100
# of Children in Group		
1	121	36.78
2	87	26.44
≥3	121	36.78
Total	329	100

Table 6: Reported Park-Based Physical Activity (PA)

Variable	Frequency (n)	Percentage (%)
Any PA during visit		
Yes	849	77.25
No	246	22.38
Missing	4	0.36
Total	1099	100
Moderate-Intensity PA		
None	114	13.43
1-10 minutes	39	4.59
10-19 minutes	164	19.32
20-29 minutes	111	13.07
> 30 minutes	420	49.47
Missing	1	0.12
Total	849	100
Vigorous-Intensity PA		
None	336	39.58
1-10 minutes	37	4.36
10-19 minutes	100	11.78
20-29 minutes	82	9.66
> 30 minutes	292	34.39
Missing	2	0.24
Total	849	100
MVPA ≥ 10 minutes		
Yes	789	71.79
No	306	27.84
Missing	4	0.36
Total	1099	100
Active Park Visit [a]		
Yes	576	52.41
No	515	46.86
Missing	8	0.73
Total	1099	100

[a] Engaged in at least 30 minutes of moderate or 20 minutes of vigorous intensity PA during park visit

Table 7: Univariate logistic regression assessing each independent variable and the likelihood of an active park visit

Variable	**Odds Ratio**	**95% C.I.**	**p**
Race			
White	1.00		
Black or African American	0.80	(0.61-1.04)	0.093
Asian	0.66	(0.31-1.43)	0.298
Hispanic or Latino	0.73	(0.46-1.17)	0.191
Multiple Race	0.46	(0.22-0.97)	0.041
Other	1.11	(0.61-2.03)	0.731
Gender			
Male	1.00		
Female	0.78	(0.62-1.00)	0.046
Age			
18-19	1.00		
20-29	1.60	(0.55-4.67)	0.386
30-39	1.40	(0.49-4.04)	0.531
40-49	1.92	(0.67-5.55)	0.226
50-59	2.15	(0.73-6.32)	0.163
60-69	1.85	(0.60-5.72)	0.284
≥70	1.34	(0.40-4.56)	0.637
Income			
$200,000 or more	1.00		
$150,000-$199,999	0.67	(0.4-1.13)	0.131
$100,000-$149,000	0.90	(0.57-1.43)	0.661
$75,000-$99,999	0.95	(0.58-1.56)	0.841
$50,000-$74,999	0.65	(0.42-1.02)	0.062
$25,000-$49,000	0.71	(0.44-1.13)	0.144
Less than $25,000	0.50	(0.3-0.81)	0.005
Education			
>High School	1.00		
≤High School	0.65	(0.47-0.9)	0.009
Employment Status			
Employed	1.00		
Not Employed	0.69	(0.51-0.93)	0.016
Marital Status			
Married	1.00		
Not Married	1.35	(1.06-1.72)	0.015
Children in Household			
Yes	1.00		

No	1.85	(1.44-2.37)	0.000
General Health Status			
Excellent	1.00		
Very Good	0.70	(0.51-0.95)	0.024
Good	0.50	(0.35-0.70)	0.000
Fair/Poor	0.27	(0.16-0.47)	0.000
Chronic Illness			
No	1.00		
Yes	0.99	(0.72-1.38)	0.968
BMI	0.98		
Normal Weight	1.00		
Underweight	1.70	(0.57-5.05)	0.341
Overweight	1.00	(0.76-1.31)	0.980
Obese	0.80	(0.58-1.11)	0.184
Mode of Transportation			
Car	1.00		
Public Transportation	0.77	(0.34-1.77)	0.538
Bike	1.24	(0.73-2.1)	0.417
On Foot	0.70	(0.52-0.96)	0.026
Other	0.42	(0.08-2.31)	0.318
With Children in Group			
No [a]	1.00		
Yes	0.33	(0.25-0.43)	0.000
With Partner in Group			
No [a]	1.00		
Yes	0.59	(0.45-0.77)	0.000
With Other Family Member in Group			
No [a]	1.00		
Yes	0.38	(0.29-0.5)	0.000
With Friends in Group			
No [a]	1.00		
Yes	1.42	(1.06-1.9)	0.017
With Community Group			
No [a]	1.00		
Yes	1.52	(0.95-2.46)	0.084
Park Site			
Park C	1.00		
Park A	0.59	(0.3-1.14)	0.117
Park B	1.21	(0.95-1.55)	0.130
Month			

May	1.00		
June	0.92	(0.67-1.27)	0.624
July	1.23	(0.82-1.85)	0.325
August	0.98	(0.66-1.47)	0.935
September	1.17	(0.77-1.76)	0.463
Visited Park on a Weekend			
No	1.00		
Yes	1.51	(1.19-1.93)	0.001
Time Arrived at Park			
5:30am-10:59am	1.00		
11am-3:59pm	0.55	(0.42-0.73)	0.000
4pm-8:30pm	0.48	(0.35-0.66)	0.000
Temperature (°F)	0.98	(0.96-0.99)	0.004
Relative Humidity (°F)	1.01	(1-1.02)	0.008
Dew Point (°F)	1.00	(0.98-1.02)	0.937
Wet Bulb Temperature (°F)	0.99	(0.97-1)	0.196

[a] Includes visitors who came to the park alone

Table 8: Multivariate logistic regression model assessing independent variables and the likelihood of an active park visit [a]

Variable	Odds Ratio	95% C.I.	p
Race			
White	1.00		
Black or African American	0.98	(0.65-1.47)	0.910
Asian	0.64	(0.27-1.52)	0.310
Hispanic or Latino	0.96	(0.53-1.74)	0.884
Multiple Race	0.45	(0.17-1.13)	0.090
Other	0.82	(0.36-1.86)	0.637
Gender			
Male	1.00		
Female	0.88	(0.65-1.19)	0.400
Age			
18-19	1.00		
20-29	1.45	(0.31-6.76)	0.638
30-39	1.35	(0.29-6.31)	0.701
40-49	1.66	(0.36-7.74)	0.517
50-59	1.50	(0.32-7.1)	0.611
60-69	1.22	(0.24-6.12)	0.806
≥70	0.88	(0.16-4.96)	0.883
Income			
$200,000 or more	1.00		
$150,000-$199,999	0.60	(0.33-1.11)	0.106
$100,000-$149,000	0.61	(0.35-1.06)	0.080
$75,000-$99,999	0.68	(0.37-1.23)	0.202
$50,000-$74,999	0.46	(0.26-0.84)	0.010
$25,000-$49,000	0.55	(0.29-1.04)	0.066
Less than $25,000	0.48	(0.23-0.97)	0.042
Education			
>High School	1.00		
≤High School	0.85	(0.52-1.38)	0.510
Employment Status			
Employed	1.00		
Not Employed	0.94	(0.6-1.46)	0.774
Marital Status			
Married	1.00		
Not Married	1.43	(1.02-2.01)	0.037
General Health Status			

Excellent	1.00		
Very Good	0.65	(0.45-0.95)	0.026
Good	0.48	(0.31-0.74)	0.001
Fair/Poor	0.22	(0.11-0.44)	0.000
Chronic Illness			
No	1.00		
Yes	1.31	(0.87-1.98)	0.202
BMI	1.02	(0.99-1.05)	0.310
Normal Weight	1.00		
Underweight	1.86	(0.51-6.72)	0.345
Overweight	1.22	(0.86-1.71)	0.262
Obese	1.41	(0.92-2.17)	0.113
Mode of Transportation			
Car	1.00		
Public Transportation	0.52	(0.19-1.44)	0.209
Bike	0.75	(0.41-1.39)	0.365
On Foot	0.55	(0.37-0.82)	0.003
Other	0.34	(0.05-2.22)	0.259
With Children in Group			
No [b]	1.00		
Yes	0.48	(0.32-0.74)	0.001
With Partner in Group			
No [b]	1.00		
Yes	0.55	(0.39-0.79)	0.001
With Other Family Member in Group			
No [b]	1.00		
Yes	0.57	(0.37-0.88)	0.012
With Friends in Group			
No [b]	1.00		
Yes	0.94	(0.66-1.35)	0.747
With Community Group			
No [b]	1.00		
Yes	1.28	(0.71-2.3)	0.420
Park Site			
Park C	1.00		
Park A	1.19	(0.82-1.72)	0.361
Park B	0.63	(0.29-1.36)	0.239
Visited Park on a Weekend			
No	1.00		
Yes	1.18	(0.79-1.77)	0.409

Time Arrived	0.83	(0.57-1.2)	0.318
5:30am-10:59am	1.00		
11am-3:59pm	0.71	(0.5-1)	0.051
4pm-8:30pm	0.61	(0.39-0.98)	0.040
Temperature (°F)	0.99	(0.97-1.01)	0.398
Relative Humidity (°F)	1.01	(0.99-1.02)	0.370

[a] Hosmer-Lemeshow test: χ^2= 9.86; df= 8; p= 0.275
Log-likelihood chi-square test: χ^2= 160.72, df=44; p= 0.000
Pseudo R^2 = 0.1193.
[b] Includes visitors who came to the park alone

Figure 3: Differences in accelerometer step count by self-reported physical activity

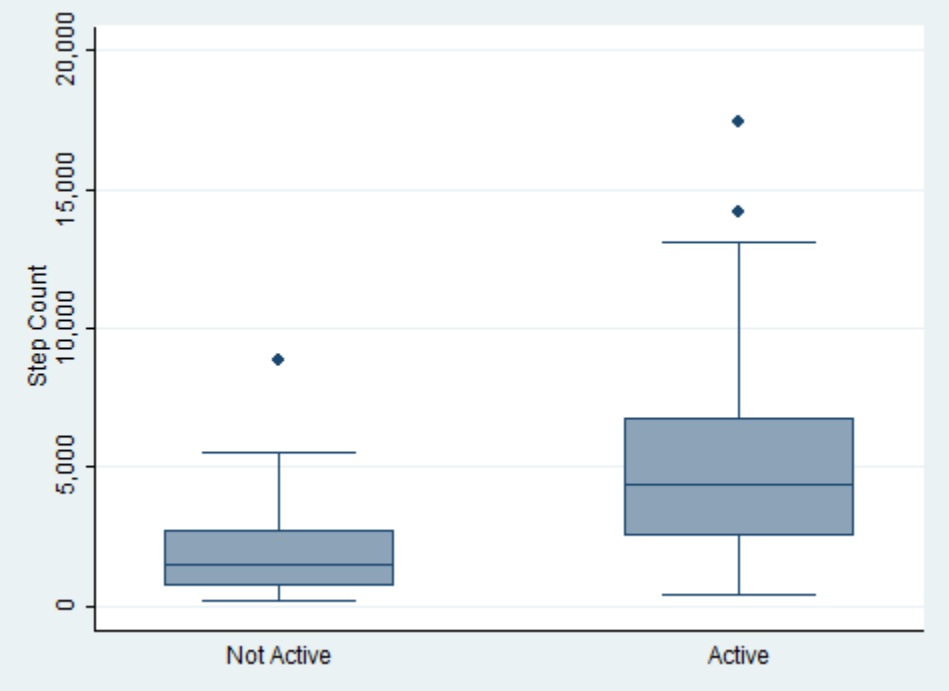


Figure 4: Differences in accelerometer distance by self-reported physical activity

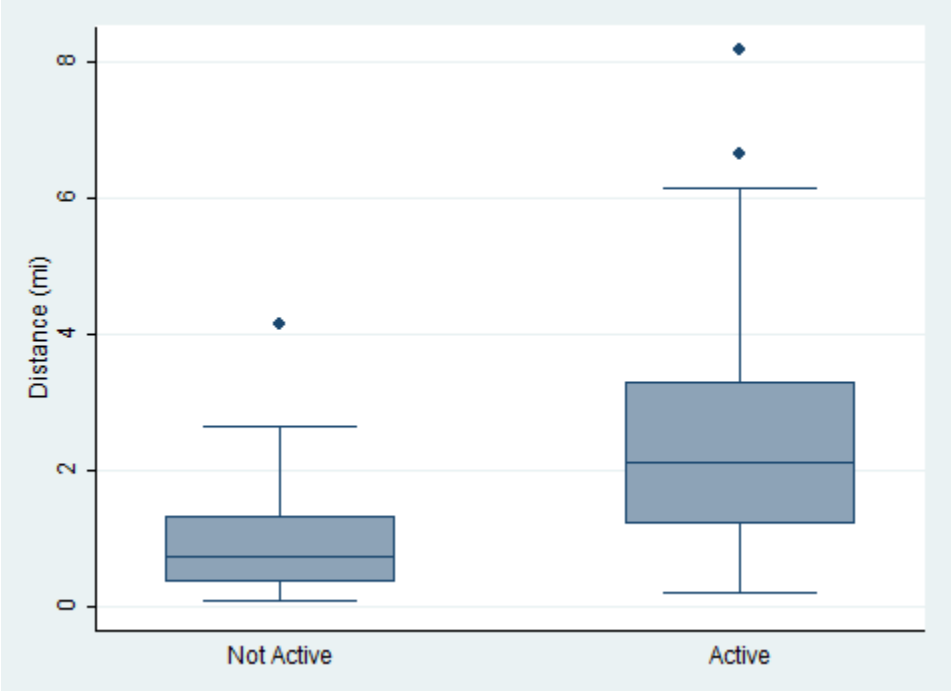
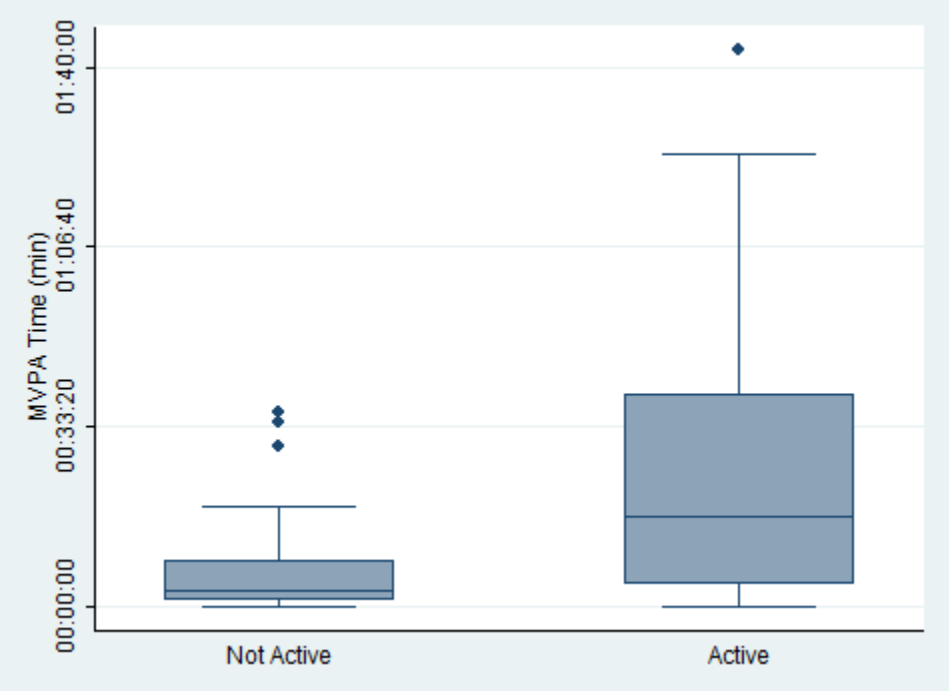


Figure 5: Differences in accelerometer MVPA Time by self-reported physical activity



CHAPTER 3: MANUSCRIPT 2

PSYCHOSOCIAL FACTORS ASSOCIATED WITH PHYSICAL ACTIVITY AMONG VISITORS TO URBAN NATIONAL PARKS

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ABSTRACT

Racial/ethnic disparities exist in meeting national physical activity (PA) recommendations. While urban national parks are well positioned to facilitate PA among communities of color, limited research has been carried out in such settings. In the current investigation, we examined how psychosocial factors (i.e., self-efficacy, self-regulation, outcome expectancies, and perceptions of the social and physical environment) may contribute to reported sociodemographic differences in park-based PA that have been previously observed. A sample of 1099 visitors to three urban national parks in Washington, D.C. completed a self-administered survey from May to September 2014. More than half of the sample were racial/ethnic minorities (n= 650), with African Americans representing the largest subgroup (n= 493). Logistic regression was used to examine the association of psychosocial factors with park-based PA while controlling for several sociodemographic factors, visitor group composition, and weather. We found that visitors reporting higher levels of self-regulation and self-efficacy were more likely to engage in an active park visit. Outcome expectancies and most perceptions of the environment were not significantly associated with PA. These findings suggest additional considerations should be taken into account when encouraging PA among park visitors with diverse backgrounds.

Keywords: exercise, national park, urban, health disparities, social determinants

DISCLAIMER:

The Views expressed are those of the authors and do not necessarily reflect the official views of the Uniformed Services University of the Health Sciences or the United States' Department of Defense.

INTRODUCTION

Physical activity (PA) plays an important role in preventing disease and contributing to an individual's wellbeing (84). The 2013 Behavioral Risk Factor Surveillance Survey (BRFSS) found that racial/ethnic disparities exist in meeting national PA recommendations. African Americans (43.8% reported 150 minutes of aerobic PA per week) and Latinos/Hispanics (43.7%) are less likely to engage in the recommended 150 minutes of aerobic PA per week than Whites (53.6%). Since racial/ethnic minorities are particularly at risk for sub-optimal health outcomes associated with physical inactivity (79), examination of facilitators and barriers associated with PA among these population subgroups is needed.

One setting that may be well-suited for PA investigations among at-risk subgroups are urban parks (70). They may be in close proximity to communities of color, free or low cost to use, and offer spaces for diverse activities. Few investigations in these settings exist, which limits our understanding of how urban parks may contribute to the health of racial/ethnic minority communities. In a previous paper, we examined how sociodemographic factors and visitor group composition were associated with PA in three urban national parks (86). Urban national parks are prime locations to study PA due to the strong institutional interest from the U.S. National Park Service to promote public health and wellbeing among their visitors (76). No previous investigation, to our

knowledge, has studied the relationship of psychosocial factors with park-based PA among visitors to urban national parks. It is possible that such factors could help explain some of the sociodemographic differences that have been reported in other park-based investigations examining PA (30; 34; 39; 50; 57; 69; 73; 95; 113).

Conceptual Framework

The Social Cognitive Theory (SCT) guided this study (8). Specifically, the SCT concept of reciprocal determinism, which suggests that behavior is mutually influenced by individual and environmental factors, framed our approach to understanding factors associated park-based PA. At the individual level, the SCT posits that self-efficacy (one's confidence in being able to take action and overcome barriers), self-regulation (the process that enables an individual to create goals over time and contexts) and outcome expectancies (predicted outcomes of a particular behavior) primarily drive behavior. Environmental factors, both the social and the physical, also play a role in behavior. While environmental-level factors can be perceived or actual, we chose to focus on the former to understand whether underlying socio-cultural contexts (e.g. differing views of safety or park cleanliness) are associated with PA. Several other studies have found significant associations between individual or environmental factors and PA within other settings and populations (5; 13; 16; 17; 21; 37; 38; 40; 47; 52; 61; 65; 83; 89; 99; 103; 108; 111).

METHODS

Adult visitors to three urban national parks in Washington, D.C. were recruited to complete an anonymous, self-administered survey that took approximately 10 minutes to complete. Geospatial analysis (ArcGIS Desktop 10) was used to select national parks in

close proximity to communities with a large concentration of racial/ethnic minorities. The goal of this sampling scheme was to recruit a mix of park visitors that was sufficiently diverse to allow for statistical comparison of subgroups (35; 77; 104). Two national parks, Parks A and B, were within half a mile of census tracts with at least 95% African American residents, a distance that is associated with park use (29; 30; 97). The third site, Park C, was similarly proximal to census tracts with racial/ethnic homogeneity. Within each park, two recruitment sites were utilized to reduce the likelihood of selection bias. Recruitment sites were selected based on the following criteria: a sufficient number of visitors exited the park at the location, they were proximal to a variety of activity areas (e.g. running paths, picnic shelters, open fields), and they were near multiple transportation options (e.g. public transportation stops, walking/biking paths, and vehicle parking lots). Data collection occurred over 24 weekend days and 51 weekdays between May 6, 2014 and September 16, 2014. Recruitment occurred between the hours of 9am and 8:30pm.

Recruitment of Survey Participants

Park visitors were approached as they exited the park. For groups, a random adult was selected using the most recent birthday method (64). When several visitors and/or groups exited the park simultaneously, a data collector selected the visitor to the farther left in their field of vision. On the second such occurrence, the middle visitor was selected, then the visitor on the farthest right. This process of selection would repeat. Informed consent was obtained through a verbal, standardized introduction and an information sheet approved by the Uniformed Services University Institutional Review Board. Android™

devices, equipped with the KoboCollect application, were used for self-administrations of the electronic survey. Upon study completion, participants were given a bottle of water.

Measurement

An electronic survey was designed to assess park-based PA (dependent variable) and other variables (i.e., psychosocial and sociodemographic factors, visitor group composition, and weather). Details follow on how these constructs were operationalized.

Park-based PA

We defined an active park visit as engaging in at least 30 minutes of activity with moderate intensity or 20 minutes of activity with vigorous intensity for at least 10 minutes at a time, as suggested by Buchner and Gobster (19). Items assessing park-based PA items were adapted from the Physical Activity in the Park Setting (PA-PS) Questionnaire and the PA module from the 2011 Behavioral Risk Factor Surveillance Survey (BRFSS) (25; 109). Participants were asked a series of questions that assessed the intensity level and duration of their activity. If they indicated that they spent any time being physically active during their park visit (yes or no), they were asked if they participated in moderate or vigorous intensity activities (yes or no). Our explanation of what constituted moderate and vigorous PA was adapted from the 2008 National Health and Nutrition Examination Survey (23):

> "By moderately active we mean doing any physical movement that caused SMALL increases in your breathing or heart rate. Examples would include brisk walking or playing with kids or a dog."

> "By vigorously active we mean doing any physical movement that caused LARGE increases in your breathing or heart rate. Examples would include running or participating in a sports event like soccer."

Visitors were then asked if these activities lasted for at least one continuous 10-minute period (yes or no) and, if "yes," how many additional minutes that their activities occurred. Duration of activity was assessed on an ordinal scale in 10 minute increments.

Psychosocial factors

Three items assessed self-regulation of park-based PA. Participants who indicated that they planned to be physically active in the park before they arrived were prompted to answer a follow-up question that asked if they made any exercise goals before coming to the park that day. We classified each visitor as having "low self-regulation" if they answered "no" to the first item, "moderate self-regulation" if they answered "yes" to the first item but "no" to the second item, and "high self-regulation" if they answered "yes" to both items. Self-efficacy was assessed through two items. Using a 5-point Likert scale (not confident-extremely confident), we asked how confident that they could successfully be: 1) moderately active for at least 30 continuous minutes (or three continuous 10 minutes periods), and; 2) vigorously active for 20 continuous minutes (or two continuous 10 minute periods) during their next park visit.

Outcome expectancies were assessed through four items adapted from Anderson et al (5) and Li et al (65). Using a 5-point Likert scale ranging from extremely likely to extremely unlikely, we asked all participants how likely they felt that certain positive (feeling better physically and feeling a sense of personal accomplishment) and negative

outcomes (being injured and experiencing pain) would happen if they had increased their level of PA during their park visit that day.

Three items adapted from Willhelm Stanis et al (113) examined the perceived social environment of the park and five items assessed perceptions of the physical environment. Using a 5-point Likert scale, participants were asked how much they agreed or disagreed with a statement about a specific characteristic of the park. Social environment items measured fear of theft, fear of dogs off their leash, perceived racial/ethnic conflict, perceived crowding, and their sense of feeling welcomed by other visitors in the park that day. The physical environment was assessed through items ascertaining a visitor's perception of the park's cleanliness and whether its trails/paths and facilities were in good repair.

Sociodemographic Factors

These variables were adapted from the 2011 BRFSS questionnaire (25). They included age, gender, Hispanic/Latino status (yes or no), race, general health status, chronic illness status, educational level, household income, marital status, number of children in their household, and employment status. We also asked participants to report their height (inches) and weight (lbs). From those data we calculated body mass index (BMI) using the standard imperial formula: weight (lbs)/[height (in)]^2 x 703.

Visitor Group Composition

These factors were assessed using five items. We asked if they were with anyone during their park visit. If they indicated "yes," they were asked to categorically describe their group composition (i.e. partner, other family members, friends, community group, and/or

other), the presence of adults (≥18 years old) and children (<18 years old), and the number of their companions that fell into each of the age categories.

Weather

Temperature, relative humidity, dew point and wet-bulb temperature were captured using the Pyle© PTHM15 meter by study staff as participants completed the survey.

Statistical Analysis

Stata 13.1 was used for statistical analysis (96). Our primary dependent variable was coded dichotomously (0= Non-Active Visit; 1= Active Visit) for binary logistic regression analyses. We examined all variable frequencies and stratified each independent variable by the dependent variable to examine cell sizes. When cells were too sparse, adjacent variable categories were collapsed or combined to meet the assumptions of logistic regression. We conducted logistic regression analyses between each independent variable and the dependent variable to understand their univariate associations before controlling for additional factors. As suggested by Hosmer and Lemeshow (51), we excluded variables from the multivariable model if results from univariate analysis yielded a p-value below 0.25. We also introduced several interaction terms into the model to assess the significance of the multiplicative combination of select independent variables. The post-estimation tests used to assess the fit of our final model included the log likelihood chi-square and Hosmer-Lemeshow tests.

RESULTS

Our overall response rate was 58.1% of those approached. The study sample (n= 1099) was mainly comprised of racial/ethnic minorities (60%). African Americans were the

largest group (45%), followed by Whites (36%), Hispanics/Latinos of any race (8%), and several other (Asian, Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, multiple race, or other) racial/ethnic groups (11%). Nearly half of the participants (48%) were women and the overall mean age of participants was 41.3 ±0.8 years. Most participants reported having spent at least some time in college (84%), were employed (68%), and lived in a household that made $75,000 or less a year (52.1%). Respondents were equally likely to say that they had never married or were married (43% in each respective category), with 63% reporting no children in their household. The mean BMI of all participants was 26.7 ±0.3, or within the normal weight category (60). The majority of participants (83%) also reported having no chronic illness/ongoing condition, and 65% told us that they were in excellent or very good general health. More details about the sample's characteristics are included in Rabbani et al (86).

Table 9 displays the results from several logistic regression models (i.e. the univariate association of each variable with park-based PA) for the psychosocial and environmental variables that we measured. We have previously described the univariate associations between the sociodemographic factors and the likelihood of having an active park visit (86). Variables that met our cutoff significance ($p \leq 0.25$) during those analyses were included in the final multivariable logistic regression model presented in Table 10. We excluded the variables 'having children in the household' and 'wet-bulb temperature' due to their collinearity with having children in park group and temperature, respectfully.

Self-regulation was found to be highly associated with park-based PA. Park visitors who made a plan to be physically active and/or created exercise goals before their visit (moderate SR OR= 3.89; 95% CI [2.25-6.73]; high SR OR= 17.08; 95% CI [10.08-

28.92]) were much more likely to report higher levels of PA than those who did not. Self-efficacy was found to be associated with an active visit in a similar dose response fashion. Visitors who had less confidence in their ability to participate in activities with moderate intensity for at least 30 minutes on their next park visit (Confident OR= 0.43; 95% CI [0.22-0.85]; Have Some/Not At All Confident OR= 0.13; 95% CI [0.04-0.49]) were less likely to report an active visit than those who very or completely confident.

During univariate analysis, we found that if a visitor expected to be injured (OR= 1.73; 95% CI [1.18-2.54]) or in pain (OR= 1.64; 95% CI [1.22-2.21]) by being more physically active during their park visit, they had higher odds of reporting an active visit. While these factors did not remain significant in the final model, another factor became significant after adjusting for other variables. Visitors who were unlikely to feel better physically by being more active during their park visit (OR= 2.2; 95% CI [0.99-4.88]) had higher odds of having an active visit.

Only one environmental factor, disagreeing that the trails/path were in good repair visit (OR= 1.55; 95% CI [1.01-1.37]), was significantly associated with having an active visit during univariate analysis. This variable was not significant (OR= 1.11; 95% CI [0.57-2.16]) in the multivariable model, however.

Finally, visitors who reported not being married (OR= 1.69; 95% CI [1.09-2.62]) were more likely to have an active visit than those who were married. In the opposite direction, visitors who came to the park on a bicycle (OR= 0.41; 95% CI [0.2-0.86]) or by foot (OR= 0.51; 95% CI [0.31-0.83]), and those who reported having a lower perception of general health (Fair/Poor OR= 0.34; 95% CI [0.13-0.92]), were less likely to have an

active park visit than visitors who arrived by car or who had reported higher levels of general health.

DISCUSSION

Our investigation found two psychosocial factors, self-regulation and self-efficacy, to be associated with PA among visitors to urban national parks after accounting for sociodemographic factors, visitor group composition, and weather.

Higher levels of self-regulation appear to have a particularly profound association with PA engagement in an active park visit. This finding is consistent with other investigations (38; 65) and a model proposed by Anderson et al (5), who found self-regulation to be the most influential factor associated with PA among a sample of ethnically diverse adults. Further investigation on specific self-regulatory strategies among visitor subgroups, such as successful self-monitoring habits, could aid practitioners in the creation of targeted behavior change initiatives.

Our findings also suggest that self-efficacy, a well-documented predictor of PA (81), played a significant role in the likelihood of having an active park visit. While the association between visitor confidence in being moderately active for 30 minutes and reported PA remained significant in the final model, this was not the case for confidence in being vigorously active for 20 minutes. In line with previous research examining the impact of self-efficacy interventions (6; 22), strategies that aim to increase self-efficacy among park users, such as self-efficacy coaching, providing feedback on past PA performance, or exercise demonstrations that promote vicarious learning, should be considered when creating park-based health promotion programs.

We hypothesized that visitors who expected positive outcomes from increased levels of PA would report higher levels of activity, while those who expected negative outcomes would report lower levels. We found that the negative outcome expectancies were associated with PA -- until we controlled for the effects of self-efficacy and other factors through multivariable modeling. This pattern is in line with Bandura's observation that outcome expectancies will only make small contributions to behavior after accounting for self-efficacy (9). While one positive outcome expectancy, feeling better physically, was associated with PA in the final model, it was in a different direction than we had predicted. Visitors who are already active, for instance, may not believe that an increase in their PA would affect their expectations, especially if they feel that their current activity levels already make them feel fit.

Perceptions of the environment were not associated with PA in our multivariate model. This differs from another study (113), which found that fears of physical/sexual assault and racial conflict, feeling unwelcome and perceiving too many people in the park were barriers to PA. These differences could be attributed to differing methodologies, populations and/or settings. Their investigation, for instance, included fewer African Americans but had a greater proportion of Hispanic/Latino visitors than our sample. Their samples were also drawn from both urban and non-urban parks. Future research examining perceived environmental factors associated with PA within urban national parks or parks that serve large proportions of ethnically diverse visitors could help us understand if differences by race/ethnicity exist.

Several visitor characteristics found to be associated with an active park visit in an earlier report from this work (86) lost significance after introducing psychosocial and

environmental variables into the model. These included: reporting a higher household income, coming to the park during early morning hours, and not being part of visitor group that included children, a partner, or other family members. Factors that remained significant from the previous report included: reporting a higher level of general health, driving a car to the park, and not being married. These findings indicate the importance of not only multivariable modeling, but also including variables that operate on different levels (i.e., intrapersonal, interpersonal, social, and organizational) when examining health behavior in parks. Evidence-based health behavior theory should be used to inform both research and program planning efforts.

Limitations

Since our survey data were self-reported, reporting may have been influenced by several potential biases. Social desirability may have affected participant PA and sociodemographic estimates. We designed the survey to be self-administered on electronic tablets in hopes that participants would feel comfortable reporting potentially sensitive information (e.g. their weight, race, income, etc.). The survey may also have been prone to recall bias, particularly as participants recalled their PA levels. This may have been minimalized since the survey was administered immediately after activity was completed in the field, compared to other instruments that ask participants to provide activity estimates over prior days or weeks (23; 25; 109). We also used accelerometers to validate our self-reports of PA among a subset of our overall sample (n= 100), which we describe in detail elsewhere (86). Visitors who reported having had an active park visit took approximately three times as many steps, traveled approximately three times the distance and spent roughly five times the number of minutes engaged in moderate to

vigorous PA, when compared to those who reported a non-active visit. This methodological step seldom occurs in studies that utilize self-reports of PA (73; 85; 90; 101; 109; 113).

Due to the cross-sectional nature of this study, the causal direction of significant associations cannot be determined. Our findings provide justification for carrying out research in the future that might elucidate causal connections between the facilitators/barriers we identified and park-based PA. Finally, our sample was drawn from urban national parks in Washington, D.C., so the generalizability of our findings--particularly to national parks in rural environments— cannot be ascertained. Our recruitment sites, based on their size, location and visitor populations, more closely resembled community-level parks embedded within urban communities.

CONCLUSION

Our findings suggest that psychosocial factors should be considered when examining PA among diverse visitors to urban national parks. They can inform future park interventions by employing techniques that maximize visitor self-regulation and self-efficacy levels. Strategies that leverage these behavioral constructs (6; 22; 72) may have greater success in increasing the proportion of park visitors who engage in a physically active visit. Professionals with training in health-related behavior are poised to significantly contribute to the planning of initiatives that aim to promote PA and health among park visitors.

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Table 9: Psychosocial and environmental factors associated with park-based physical activity – Univariate logistic regression

Variable	Odds Ratio	95% C.I.	p
Self-Regulation (n= 1096)			
Low Self-Regulation	1.00		
Moderate Self-Regulation	4.82	(3.16-7.37)	0.000
High Self-Regulation	21.31	(14.42-31.49)	0.000
Self-Efficacy			
Moderate-Intensity PA for 30 Minutes (n= 1093)			
Completely/Very Confident	1.00		
Confident	0.25	(0.17-0.37)	0.000
Have Some/Not At All Confident	0.08	(0.03-0.2)	0.000
Vigorous-Intensity PA for 20 Minutes (n= 1094)			
Completely/Very Confident	1.00		
Confident	0.34	(0.23-0.49)	0.000
Have Some/Not At All Confident	0.27	(0.19-0.39)	0.000
Outcome Expectancies			
Injured (n= 1095)			
Unlikely	1.00		
Neutral	1.34	(0.97-1.86)	0.079
Likely	1.73	(1.18-2.54)	0.005
Felt Better Physically (n= 1092)			
Likely	1.00		
Neutral	1.63	(1.2-2.23)	0.002
Unlikely	1.13	(0.71-1.8)	0.607
Experienced Pain (n= 1093)			
Unlikely	1.00		
Neutral	1.41	(1.05-1.89)	0.023
Likely	1.64	(1.22-2.21)	0.001
Felt Sense of Personal Accomplishment (n= 1095)			
Likely	1.00		
Neutral	1.13	(0.78-1.64)	0.529
Unlikely	1	(0.59-1.7)	0.995
Perceived Social Environment			
Too Many People (n= 1094)			
Agree	1.00		
Neither	1.01	(0.65-1.56)	0.981
Disagree	0.96	(0.66-1.4)	0.829

Afraid of Theft (n= 1094)			
Agree	1.00		
Neither	1.06	(0.65-1.75)	0.807
Disagree	0.9	(0.6-1.37)	0.634
Afraid of Racial/Ethnic Conflict (n= 1095)			
Agree	1.00		
Neither	0.62	(0.31-1.25)	0.178
Disagree	0.65	(0.37-1.14)	0.133
Afraid of Dogs Off Leash (n= 1093)			
Agree	1.00		
Neither	1	(0.63-1.57)	0.985
Disagree	0.78	(0.54-1.13)	0.192
Felt Unwelcome by Other Visitors (n= 1094)			
Agree	1.00		
Neither	0.75	(0.39-1.45)	0.399
Disagree	0.8	(0.48-1.32)	0.376
Perceived Physical Environment			
Park Was Clean (n= 1094)			
Agree	1.00		
Neither	0.64	(0.41-1.01)	0.054
Disagree	0.93	(0.58-1.49)	0.754
Trails/Paths in Good Repair (n= 964) [a]			
Agree	1.00		
Neither	0.9	(0.61-1.34)	0.616
Disagree	1.55	(1.01-1.37)	0.045
Park Facilities in Good Repair (n= 965) [a]			
Agree	1.00		
Neither	0.75	(0.52-1.08)	0.123
Disagree	0.91	(0.61-1.35)	0.630

Note. [a] This variable does not include participants that indicated that they had not used this park feature during their visit that day

Table 10: Psychosocial and environmental factors associated with park-based physical activity – Multivariable logistic regression

Variable	Odds Ratio	95% C.I.	p
Self-Regulation (n= 1096)			
Low Self-Regulation	1.00		
Moderate Self-Regulation	3.89	(2.25-6.73)	0.000
High Self-Regulation	17.08	(10.08-28.92)	0.000
Self-Efficacy			
Moderate-Intensity PA for 30 Minutes (n= 1093)			
Completely/Very Confident	1.00		
Confident	0.43	(0.22-0.85)	0.015
Have Some/Not At All Confident	0.13	(0.04-0.49)	0.002
Vigorous-Intensity PA for 20 Minutes (n= 1094)			
Completely/Very Confident	1.00		
Confident	0.61	(0.33-1.12)	0.110
Have Some/Not At All Confident	0.67	(0.37-1.22)	0.188
Outcome Expectancies			
Injured (n= 1095)			
Unlikely	1.00		
Neutral	1.04	(0.62-1.75)	0.877
Likely	1.73	(0.86-3.45)	0.123
Felt Better Physically (n= 1092)			
Likely	1.00		
Neutral	1.30	(0.81-2.11)	0.280
Unlikely	2.20	(0.99-4.88)	0.054
Experienced Pain (n= 1093)			
Unlikely	1.00		
Neutral	1.11	(0.69-1.78)	0.675
Likely	1.15	(0.7-1.9)	0.584
Perceived Social Environment			
Afraid of Racial/Ethnic Conflict (n= 1095)			
Agree	1.00		
Neither	0.61	(0.19-1.92)	0.398
Disagree	0.84	(0.33-2.18)	0.722
Afraid of Dogs Off Leash (n= 1093)			
Agree	1.00		
Neither	1.03	(0.49-2.15)	0.937
Disagree	0.95	(0.5-1.82)	0.886
Perceived Physical Environment			

Park Was Clean (n= 1094)			
Agree	1.00		
Neither	1.10	(0.54-2.25)	0.784
Disagree	1.20	(0.58-2.51)	0.619
Trails/Paths in Good Repair (n= 964) [a]			
Agree	1.00		
Neither	0.77	(0.42-1.4)	0.396
Disagree	1.11	(0.57-2.16)	0.762
Race (n= 1084)			
White	1.00		
Black or African American	0.85	(0.5-1.45)	0.555
Asian	0.98	(0.33-2.93)	0.972
Hispanic or Latino	0.66	(0.31-1.4)	0.277
Multiple Race	0.57	(0.16-2.08)	0.395
Other	1.15	(0.4-3.32)	0.799
Gender (n= 1098)	0.74	(0.5-1.09)	0.126
Male	1.00		
Female			
Age (n= 1093)	1.00	(0.99-1.02)	0.632
Income (n= 1042)			
$200,000 or more	1.00		
$150,000-$199,999	0.76	(0.35-1.65)	0.487
$100,000-$149,000	0.67	(0.33-1.36)	0.272
$75,000-$99,999	1.02	(0.47-2.22)	0.963
$50,000-$74,999	0.51	(0.24-1.07)	0.077
$25,000-$49,000	0.95	(0.42-2.12)	0.895
Less than $25,000	0.65	(0.26-1.62)	0.352
Education (n= 1086)			
Completed High School or Higher	1.00		
Completed Less than High School	0.72	(0.39-1.35)	0.310
Employment Status (n= 1077)			
Employed	1.00		
Not Employed	1.05	(0.6-1.84)	0.877
Marital Status (n= 1080)			
Married	1.00		
Not Married	1.69	(1.09-2.62)	0.020
General Health Status (n= 1089)			
Excellent	1.00		
Very Good	0.89	(0.55-1.45)	0.651
Good	0.78	(0.44-1.38)	0.390
Fair	0.34	(0.13-0.92)	0.033

Chronic Illness (n= 1072)			
No	1.00		
Yes	1.00	(0.59-1.7)	0.990
BMI (n= 1062)	0.99	(0.95-1.03)	0.525
Mode of Transportation (n= 1096)			
Car	1.00		
Public Transportation	0.80	(0.22-2.94)	0.739
Bike	0.41	(0.2-0.86)	0.018
On Foot	0.51	(0.31-0.83)	0.007
Other	0.37	(0.02-7.55)	0.516
With Children in Group (n= 1099)			
No [b]	1.00		
Yes	0.90	(0.52-1.57)	0.719
With Partner in Group (n= 1099)			
No [b]	1.00		
Yes	0.74	(0.47-1.16)	0.190
With Other Family Member in Group (n= 1099)			
No [b]	1.00		
Yes	0.59	(0.34-1.02)	0.060
With Friends in Group (n= 1099)			
No [b]	1.00		
Yes	1.04	(0.65-1.66)	0.870
With Community Group (n= 1099)			
No	1.00		
Yes	0.87	(0.38-2.01)	0.745
Site (n= 1099)			
Park A	1.00		
Park B	1.06	(0.36-3.17)	0.913
Park C	1.20	(0.74-1.95)	0.460
Visited on a Weekend (n= 1099)			
No	1.00		
Yes	0.96	(0.56-1.62)	0.865
Arrived at Park (n= 1077)			
5:30am-10:59am	1.00		
11am-3:59pm	0.72	(0.46-1.14)	0.159
4pm-8:30pm	0.62	(0.33-1.15)	0.129
Temperature, °F (n= 1099)	1.00	(0.97-1.03)	0.838
Relative Humidity, °F (n= 1099)	1.00	(0.98-1.01)	0.617

Note. Log-likelihood chi-square test: χ^2= 353.11, df=57; p= 0.000; Hosmer-Lemeshow test: χ^2= 13.02; df= 8; p= 0.11; Pseudo R^2 = 0.319.

[a] This variable does not include participants that indicated that they had not used this park feature during their visit that day

[b] Includes visitors who came to the park alone

CHAPTER 4: CONCLUSION

DISCUSSION

The primary goal of our investigation was to identify factors associated with physical activity in urban national parks. This knowledge improves our ability to support adults from diverse sociodemographic subgroups to achieve desired physical activity levels. We addressed Specific Aims 1 and 2 (determining the proportion of visitors who reported engaging in an active park visit, and if there were sociodemographic differences) in Chapter 2. Specific Aim 3 (assessing psychosocial and environmental factors associated with an active park visit) was examined in Chapter 3, where we revisited the first two specific aims to understand whether the psychosocial factors measured in this study could account for previously observed sociodemographic differences in park-based physical activity.

We have contributed to the body of knowledge in two primary ways. First, we successfully selected a sample of park visitors (N= 1099) that included a large proportion of racial/ethnic minorities. Over half of the participants in our sample identified as a racial/ethnic minority (63%), with African Americans comprising the largest proportion (45%). The 2008 Physical Activity Guidelines Advisory Committee Report, the first comprehensive guidelines on physical activity issued by the U.S. federal government, outlined the urgent need to gather physical activity data on understudied populations, which includes racial/ethnic minorities (84). This urgency is based on several factors: racial/ethnic minorities have a larger burden of chronic disease associated with physical inactivity than non-Hispanic Whites, there has been limited physical activity data on racial/ethnic minority populations in the scientific literature, and among studies that have included racial/ethnic minorities in their samples, most do not achieve sub-group samples of sufficient size to allow for meaningful statistical comparisons (84).

Second, to our knowledge, we are the first study to examine facilitators and barriers associated with physical activity in urban national parks. As outlined in previous chapters, urban parks are well suited for physical activity intervention, particularly among communities of color, due to their proximity to neighborhoods with high proportions of racial/ethnic minorities, their minimal cost to utilize, and the diverse spaces that they offer for activity. Additionally, urban parks operated by the National Park Service are part of a recent institutional research agenda (75) and initiative, *Healthy Parks, Healthy People*, which aim to position national parks as places for health and wellbeing (78). Strong institutional support from the park sector is needed to implement recommendations that might arise from this and other behavioral assessments.

In Chapter 2, we assessed the intensity and duration of park-based physical activity among adult visitors. Among all visitors in our sample (N= 1099), we found that most reported some level of physical activity (77.25%) and about half (52.41%) engaged in enough activity to be classified as an active park visit (i.e., they engaged in at least 30 minutes of moderate or 20 minutes of vigorous intensity PA during park visit for at least 10 minutes at a time). Among those who indicated that they had spent time being physically active during their visit (n= 849), more visitors reported engaging in moderate-intensity physical activity (86.57%) than in vigorous activity (60.42%). These findings are in line with another study that found that adult visitors to state parks in Pennsylvania were more likely to report participation in moderate-intensity physical activity than vigorous activity (73). While it is encouraging that a large proportion of visitors spent some time being physically active during their visit, our findings suggest that many could benefit from being active for longer periods of time. It is unknown whether visitors were

aware of national physical activity recommendations, if they felt that their current levels were sufficient, or if they believed that their park visit meaningfully contributed to their physical activity regimen (if one existed). This information could be obtained through further research, which would inform researchers of attitudes towards parks as spaces for physical activity and potential gaps in knowledge about physical activity recommendations. Future practitioners aiming to create programs that encourage physical activity among park visitors could also use our adaptation of Buchner and Gobster's (19) definition of an active park visit as a desired, and measurable, outcome. This would allow practitioners to evaluate the impact of their health promotion program and understand whether participants achieved an active visit after program participation, thereby quantifying the level of programmatic success (e.g., "50% of participants who successfully completed the program went from having a non-active park visit to having an active visit once a week").

Our accelerometer results support the notion that our survey sample's self-reports of physical activity levels were valid, even though there were indications of overreporting (explained below). To our knowledge, no other park-based investigation examining physical activity validated their self-reports of physical activity (73; 109; 113). We built a validity check into our study design because self-reported PA data have not always proven to be valid (85; 90; 101). As shown in our figures in Chapter 2, our accelerometer results were in the expected direction: visitors who reported engaging in an active park visit took significantly more steps, traveled significantly longer distances and spent significantly more time participating in MVPA than those who reported a non-active visit.

Marshall et al (68) recommend that adults walk at least 3000 steps in 30 minutes per day, five times a week, to meet the CDC's weekly recommendation of 150 minutes of moderate-intensity physical activity. Active park visitors in our study had a median step count of 4379 steps (compared to 1499 median steps among non-active visitors), which exceeds this daily recommendation. Step counts do not measure physical activity intensity, however. Our accelerometers measured the number of minutes that participants engaged in moderate-to-vigorous physical activity, which gave us further insight on whether they likely met daily physical activity recommendations. Active visitors had a median MVPA time of 16.6 minutes, while non-active visitors had a median MVPA time of 2.93 minutes during their visit. Our accelerometers were only able to record moderate and vigorous intense activity together as one metric, so we were unable to examine differences between these intensity levels. Nonetheless, the median number of MVPA minutes among visitors who reported an active visit is lower than our operationalized definition of an active visit in the self-reported survey (i.e., 30 minutes of moderate-intensity activity or 20 minutes of vigorous-intensity activity for at least 10 minutes at a time). The median MVPA duration among non-active visitors, however, meets our definition of a non-active visit (i.e., less than 30 minutes of moderate-intensity activity or 20 minutes of vigorous-intensity activity). This suggests that visitors overreported their minutes of park-based physical activity in our survey, which may have caused some true non-active visitors to be misclassified as active visitors. The true proportion of active visitors (52.41%) in our sample (N= 1099) may therefore be lower than reported.

The lack of published validation studies examining park-based physical activity prevents us from comparing our validation findings to other investigations in similar

settings. A literature review that examined direct versus self-reported measures of general physical activity in adults found no clear pattern of over- or under-reporting from self-reports (85). Since our direct and self-reported measures were not on the same scale, the former being continuous minutes and the latter being ordinal minutes, we were unable to calculate a mean difference that would allow us to precisely assess the extent of potential over- or under-reporting in our self-reported instrument. The use of more advanced accelerometers in future research could also allow us to examine whether visitors were more likely to overreport moderate or vigorous intense activities, or both. In addition, we do not know the frequency of park visits per week among our sample, nor how much of their overall physical activity occurs in other settings (e.g., neighborhoods, gyms). This information could help us understand the extent that park visits contribute to CDC weekly physical activity recommendations.

Recently, several studies that have examined park-based physical activity have relied on a direct observational instrument called System for Observing Physical Activity and Recreation in Communities (SOPARC). As discussed in Chapter 2, while direct observation has its merits (e.g., SOPARC observations of visitor physical activity intensity levels have been found to have acceptable inter-rater reliability), there is no evidence that observers can accurately categorize race/ethnicity through observation alone (71). In addition, direct observational instruments do not assess several factors that may confound the relationship between race/ethnicity and physical activity (e.g. income, education, psychosocial factors), as informed by theoretical constructs. This highlights a strength of our study design – we measured several variables that help explain the

complex web of factors that are associated with park-based physical activity, while also using a physical activity instrument that has been examined for its validity.

Eight sociodemographic and group composition variables were found to be significantly associated with an active visit in our final model (see Chapter 2). These included having a higher income, driving to the park, arriving at the park during early morning hours, reporting higher levels of general health, not being married, or not being part of a visitor group with children, a partner, or other family members. In Chapter 3, we introduced psychosocial factors into this same model to understand how they may affect the previously established significant associations. As suggested by the Social Cognitive Theory (7), the psychosocial factors (i.e., self-efficacy, self-regulation, outcome expectancies) and perceptions of the social and physical environment that we measured significantly accounted for much of the physical activity variation in our final model. Self-regulation and self-efficacy, two factors that have been consistently found to be associated with physical activity in other settings (5; 38; 65; 81), were the primary factors associated with the dependent variable in our final model. Few sociodemographic and group composition variables remained significant once our psychosocial elements were introduced. Visitors who were not married, had a higher self-perception of general health status and came to the park in a car were more likely to have an active visit than otherwise after accounting for the psychosocial factors. Upon further examination of the relationship between variables that lost significance and self-regulation (see Appendix H), we found all of them to be significantly associated with each other. For example, visitors who were not part of a group with their partner, other family members, or children had higher levels of self-regulation than otherwise. These group variables, it

appears, masked the significant association between self-regulation and park-based physical activity found in the more complex model presented in Chapter 3.

As previously discussed, we did not find race/ethnicity to be associated with park-based physical activity in our final models. In Chapter 2, we gave several possible explanations for why our findings may differ from other park-based investigations. These differences could be attributed to regional or population differences, differing assessments of physical activity (self-reports versus direct observation), or the use of different statistical modeling. As in the park literature, non-park investigations examining the association between race/ethnicity and physical activity is limited (84). Since we only measured one aspect of physical activity among a non-random sample of a specific population subgroup (park visitors), our findings are not directly comparable to other general physical activity assessments that found racial/ethnic differences. This may be one reason why our findings differ from the latest data from the BRFSS in 2013, which indicates that racial/ethnic disparities in meeting recommended weekly levels of aerobic PA exist at the national level and in Washington, D.C. (28).

Park visitors may have different characteristics, behaviors, attitudes, or perceptions than non-park visitors. Examination of general physical activity informed the SCT among D.C. residents would help us understand whether the significant associations found in our study exist on a broader level. A non-active visitor in our study may also meet recommended levels of physical activity in other settings, or during a different park visit. A more comprehensive assessment of physical activity could provide insight on whether a subset of non-active visitors (i.e., those who do not meet recommended levels in any setting) should be targeted.

We are unaware of existing literature that examines the 2013 BRFSS physical activity data with multivariate analysis to understand whether other factors confound the relationship between race/ethnicity and general physical activity. Since we found that racial/ethnic associations with park-based physical activity lost significance in our multivariable models, a finding supported by other studies that examined physical activity with similar statistical methodologies (49; 117), a multivariate examination of the BRFSS data could allow us to a better compare our park-based findings with general physical activity levels. Multivariate analyses examining psychosocial factors associated with different aspects of physical activity are needed to better understand the complex etiology of racial/ethnic disparities, particularly when conclusions are being drawn from national datasets (e.g., BRFSS, NHANES).

It should be noted that several aspects of the SCT were not examined in our study, such as observational learning, moral disengagement, behavioral capability, and reinforcements. Instead, we examined SCT constructs that have been previously found to be associated with physical activity (see Chapter 1, Social Cognitive Theory section). We additionally utilized the concept of reciprocal determinism to frame our investigation and conceptual model. Our investigation therefore only examined the hypothesized paths of select SCT constructs when examining factors associated with park-based physical activity. Our logistic regression findings do suggest, though, that the inclusion of SCT constructs in our model accounts for a greater proportion of physical activity variance than in our earlier model without these factors. The Pseudo R^2, a measure between 0 and 1 of how well a logistic regression model fits the data, for our psychosocial model in Chapter 3 (Table 10) was 32%, compared to 12%, in our sociodemographic model in

Chapter 2 (Table 8). Baranowski et al (11) recommend that for a theory to be considered useful when developing physical activity interventions, the variance in physical activity should be greater than 30%, a cutoff point that our psychosocial model meets.

Our findings are also consistent with previous research studying the use of the SCT to explain physical activity. Young et al conducted a meta-analysis of 44 studies examining 55 SCT physical activity models among several different populations and found that SCT constructs accounted for 31% of variance in physical activity (118). This level of variance is nearly identical to the level in our psychosocial model (32%). In addition, they found self-efficacy and goals (i.e., self-regulation) to be consistently and positively associated with physical activity. Outcome expectancies and socio-structural factors, which include perceptions of the environment, were generally not associated. Our findings are consistent with these results, even though we only measured one aspect of physical activity (i.e., occurring during a park visit). By conducting our investigation within the framework of the SCT, we benefitted from being able to design our study and interpret our findings in a systematic way. This also allowed us to compare our results to other physical activity investigations grounded in the SCT.

While we are unaware of any physical activity intervention with psychosocial components aimed at park visitors, several such interventions exist in non-park settings (6; 22; 72). These interventions suggest that physical activity self-regulation and self-efficacy are modifiable and, if meaningful and positive effect size changes are achieved, significantly increase physical activity levels within target populations. These programs tend to take a multidisciplinary approach utilizing health and physical education, social support, and self-monitoring (which is an aspect of self-regulation). Among evaluated

programs that aimed to increase physical activity self-efficacy, the most successful included strategies that provided feedback on the past performance of participants and opportunities for vicarious experience (6). Future studies could investigate whether similar techniques are effective in increasing physical activity levels among diverse visitors to urban national parks. For example, the NPS could evaluate the effectiveness of a pilot intervention aiming to increase the number of physically active visits (using our operationalized definition) by targeting park visitors who arrived by foot. Visitors who agreed to participate would attend a weekly session that include strategies to increase physical activity self-efficacy and self-regulation. Exercise demonstrations could increase participant confidence in their own ability to complete similar activities (through vicarious experience), while handing out calendars, and providing strategies on how to self-monitor, could encourage participants to plan and track their physical activity. Evaluation of effect size changes for the main outcome (i.e., frequency of active visits) and intermediate outcomes (i.e., levels of physical activity self-regulation and self-efficacy) at baseline, the midpoint and completion would provide a measureable way to assess success. If such a pilot intervention was deemed successful, the NPS could consider scaling their efforts to other urban national parks. Evaluation of each unique implementation would be warranted to understand the intervention's effectiveness in encouraging physical activity among the local target population.

As previously discussed, examination of physical activity outside of parks could help us understand the extent that parks contribute to the achievement of recommended physical activity levels. The NPS could additionally benefit from investigations on how their parks may encourage such non-park activity. National park visitors, for example,

may engage in physical activity to or from the park. We currently do not know the type, intensity level, or duration of such activity. National parks could also encourage general physical activity by serving as an incentive to physical activity interventions. An employee program designed to increase workplace physical activity could incentivize participation by providing a free trip to a national park to those who successfully reach their goals. Park staff could facilitate this by working with local organizations to plan, design, and fund such programs and excursions.

Given the ethnic diversity of our sample, our findings indicate that interventions addressing constructs from the Social Cognitive Theory (e.g., self-regulation and self-efficacy) may hold potential for increasing physical activity levels among diverse visitors. Tailoring according to visitors' sociodemographic characteristics should be considered during program planning and development. Even though we did not find race/ethnicity to be significantly associated with park-based physical activity in our final multivariate models, program planners should not preemptively dismiss the need for cultural (or other sociodemographic) tailoring when creating a physical activity intervention informed by our assessment. Glanz and Rimer (43) suggest that successful health promotion programs include the following elements: a clear understanding of the targeted health behavior, the environmental context in which the behavior occurs, health behavior theory, and a strategic planning model. Our study used concepts from the SCT to examine facilitators and barriers (which elucidated aspects of individual and environmental contexts around a specific behavior) associated with park-based physical activity (targeted health behavior). A strategic planning model like PRECEDE-PROCEED (46) could provide a framework for planning, creating and evaluating an

effective intervention aimed to increase physical activity among urban national park visitors. While our findings substantially contribute to the assessment stages (PRECEDE) of this framework, additional investigation of the target population is warranted before program creation. A logical next step beyond our study would be to assess the acceptability of self-regulation or self-efficacy strategies among urban national park visitors in Washington, D.C. Since the majority of the participants at two of our park sites were African American, cultural considerations may be necessary when developing key programmatic components. A qualitative study that assessed facilitators and barriers to physical activity programs among African American mothers and their daughters found strong preferences for activities that were culturally attuned (3). Participants indicated that the inclusion of non-traditional exercises (e.g., hip-hop, African, jazz, and samba dancing) would be appealing since, in addition to providing exercise, they highlight the cultural history of African Americans. A similar assessment could be conducted in urban national parks in Washington, D.C. to understand whether these or other emerging preferences resonate with local visitors. If an intervention aiming to promote self-efficacy included vicarious learning of an activity preferred by the target population, it may have greater success in attracting participants and maintaining interest.

Finally, further examination of our dataset (see Appendix G) will give us greater insight on the types of activities engaged, activity areas visited, knowledge of activity areas within the park, and preferred activity areas by different subgroups. Building upon our current findings, we could insert select activity variables into our logistic regression models to understand whether they offer additional explanation of physical activity variance. We could also examine whether the factors that were significant in our current

models are associated with these activity variables. Visitors with low self-regulation, for example, may have visited different activity areas in the park than those with higher levels. If this were the case, future research could provide insight on why preferences among such subgroups exist and whether certain activity areas reinforce or enable a visitor's ability to self-regulate their physical activity.

LIMITATIONS

Our study had several limitations. Since we used self-reports of park-based physical activity, our dependent variable was reliant on the ability of participants to properly recall and classify their activity levels. This may have caused misclassification, though that source of error should have been minimized because physical activity was assessed immediately after it was completed. Social desirability may have also biased participant physical activity estimates, weight, height, and income. We tried to minimize this source of bias by having participants submit their answers on electronic devices without the aid of a data collector. The potential for self-selection was taken into account in the design of our verbal introduction. It did not highlight physical activity, instead emphasizing that we were interested in "what visitors do in the park and how they make such decisions."

While we validated our self-reports of physical activity, we did not psychometrically examine the validity of other self-reported constructs and variables in our survey for the specific setting (urban national parks in Washington, D.C.) and population (adults visitors to these parks) that were investigated in this study. Therefore, these other factors (e.g., self-regulation, perceptions of the environment) could exhibit some level of misclassification. As described in Chapter 1, we adapted items from

instruments that found significant associations between the factors that we measured and physical activity in other settings or populations. We also conducted cognitive interviews before administering our survey to understand whether visitors similar to our study participants interpreted and comprehended our items as we intended. Further investigation examining the psychometric properties of these adapted items in urban national parks would give us greater clarity on the validity of our findings and the utility of specific items used in our survey instrument for future investigations that examine physical activity in these settings.

Since we focused on urban national parks within Washington D.C., our findings may not be generalizable to other park settings, such as rural or local community parks. We also collected data from spring into early fall. It is possible that there are seasonal differences in the type of visitors that came to the park sites. Those months were selected, however, based upon park staff's experience with maximal visitation patterns.

While our survey measured different aspects of social support, we could not analyze a subset of those data due to low frequencies that resulted from skip patterns built into our survey. This prevented us from examining the variables from the original conceptual model that related to whether participants' companions supported them in being physically active in general.

Finally, the cross-sectional nature of this investigation limits our ability to examine temporal relationships between facilitators/barriers and park-based physical activity. Further longitudinal investigation would be required to establish causality for several of the variables that we measured. For instance, a visitor may have exhibited high physical activity self-efficacy based on their immediate experience with a successful jog,

or they may have already had high confidence in their ability to be physically active, which could have enabled them to complete a successful jog during their park visit. In this scenario we are unsure which factor influenced the other without further temporal information. By measuring participant physical activity self-efficacy before a park visit, and then recording their subsequent activities during their visit, we could get a better sense of the directional relationship between self-efficacy and park-based physical activity. If, as the literature suggests in other settings, self-efficacy acts as a predictor of physical activity, we would have greater confidence that interventions that promote efficacy building would be effective in park-based health promotion programs.

CONCLUSION

The successful completion of the aims of this study will allow the National Park Service to introduce data-driven interventions that could be evaluated, with the aim of promoting active visits among visitors to urban national parks. These findings also expand our understanding of factors that are associated with physical activity in park settings used by diverse groups of people. This new knowledge, through manuscript publication and other anticipated forms of dissemination, should advance the field's ability to reduce health disparities in the United States.

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APPENDICES

A. Survey Instrument

B. Informational Sheets

C. Verbal Consent Scripts

D. Guide to Study Variables

E. Selection of Park Sites – Procedures and Spatial Analysis

F. Electronic Data Collection Procedures

G. Frequencies of Park Activities and Activity Areas

H. The Association of Self-Regulation with Select Variables

A. SURVEY INSTRUMENT

PARK VISITOR ACTIVITY RESEARCH STUDY

NOTE TO READER – This is an electronic survey. Visitors will be handed an Android tablet and they will be able to navigate by using arrows at the bottom of the screen with their fingers. The system will automatically skip to the item indicated if a respondent selects a particular option. Each item is on a separate screen.

Completed by Data Collector Before Device Handed to Participant:

Item	Values
Participant ID	Continuous
Study Site	1 = Anacostia 2 = Fort Dupont Park 3 = Rock Creek Park
[If 1 is selected] Recruitment Site in Anacostia Park:	1 = Site A (Skating Pavilion parking lot) 2 = Site B (Anacostia Dr. and Nicholson St. SE)
[If 2 is selected] Recruitment Site in Fort Dupont Park:	1 = Site A (Recreation Center parking lot) 2 = Site B (Randle Cir. SE and Fort Dupont Dr. SE)
[If 3 is selected] Recruitment Site in Rock Creek Park:	1 = Site A (Beach Dr. and Military Rd. parking lot) 2 = Site B (Fields near Stage Dr. and Morrow Dr. NW)
Date	MM/DD/YYYY
Time Started	HH:MM [AM or PM]

Device Handed to Participant:

Thanks for agreeing to participate in the Park Visitor Activity Research Study.
Please touch the right arrow at the bottom of the screen to begin.

About what time did you arrive at the park today?
Use your finger to swipe the clock dial up or down.

HH:MM [AM or PM]

How did you travel to the park today? Please select what you used the most.

1 = Car
2 = Bus
3 = Metro

4 = Biked
5 = Walked
6 = Ran/Jogged
7 = Other

[If 7 is selected] **Please tell us how you got to the park today.**

Fill in

Were you with anyone during your park visit today?

1 = Yes
2 = No

[If 1 is selected] **Please tell us who you were with during your park visit. Include adults and children.**
Please select all that apply.

1 = My partner (spouse, boyfriend/girlfriend, significant other)
2 = With other family members
3 = With friends
4 = With members of a community group that I belong to
5 = Other

[If 4 is selected] **What kind of community group would you say it is?**

1 = Religious organization
2 = Community service organization
3 = Other

[If 3 is selected] **Please tell us what kind of community group it is:**
Fill in

[If 1 is selected] **How much do you agree or disagree that YOUR PARTNER supports you in being physically active in general?**
By partner we mean your spouse, boyfriend/girlfriend or significant other.

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree

[If 2 is selected] **How much do you agree or disagree that the FAMILY MEMBERS that came with you to the park today support you in being physically active in general?**

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree

[If 3 is selected] **How much do you agree or disagree that the FRIENDS that came with you to the park today support you in being physically active in general?**

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree

[If 4 is selected] **How much do you agree or disagree that the MEMBERS OF YOUR COMMUNITY GROUP that came with you to the park today support you in being physically active in general?**

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree

[If 5 is selected] **Please tell us who you were with during your park visit:**

Fill in

[If 1 is selected] **Are the other people in your group…**

1 = Adults
2 = Children
3 = Both Adults and Children

[If 1 or 3 is selected] **How many other adults are in your group? PLEASE DO NOT COUNT YOURSELF.**

1 = 1
2 = 2

3 = 3
4 = 4
5 = 5
6 = 6
7 = 7
8 = 8
9 = 9
10 = 10
11 = More than 10

[If 11 selected] **Please tell us the total number of adults in your group. PLEASE DO NOT COUNT YOURSELF.**

Fill in

[If 2 or 3 is selected] **How many children are in your group?**

1 = 1
2 = 2
3 = 3
4 = 4
5 = 5
6 = 6
7 = 7
8 = 8
9 = 9
10 = 10
11 = More than 10

[If 11 selected] **Please tell us the total number children in your group.**

Fill in

BEFORE you arrived at the park today, did you have A PLAN to be physically active during your visit?
By physically active we mean doing any physical movement rather than leisurely walking. Some examples include brisk walking, jogging or biking.

1 = Yes
2 = No

[If 1 is selected] **BEFORE you arrived at the park today, did you make any exercise goals for your visit.**
Examples would include planning to run for 20 minutes or briskly walk for 2 miles.

1 = Yes
2 = No

DURING your time in the park today, did you spend any time being physically active?
By physically active we mean doing any physical movement beyond leisurely walking in the park. Some examples include brisk walking, jogging or biking.

1 = Yes
2 = No

[If 1 is selected] **The next set of questions will ask you about the intensity level of your physical activity. We will first ask about any MODERATE activity and then any VIGOROUS activity you may have done during your visit.**
We will define each term for you.

[If 1 is selected in PA screening item] **During your time in the park today, would you say that you spent any time being MODERATELY active?**
By moderately active we mean doing any physical movement that caused SMALL increases in your breathing or heart rate. Examples would include brisk walking or playing with kids or a dog.

1 = Yes
2 = No

[If 1 is selected] **Were you MODERATELY active for at least one continuous 10 minute period?**

1 = Yes
2 = No

[If 1 is selected] **Please tell us how long you were MODERATELY active during your time in the park today.**

1 = Between 10 minutes and 19 minutes of continuous moderate activity
2 = At least one continuous 20 minute period OR two continuous 10 minute periods of moderate activity
3 = At least one continuous 30 minute period OR three continuous 10 minute periods of moderate activity
4 = More than one continuous 30 minute period OR three continuous 10 minute periods of moderate activity

How confident are you that you could successfully be MODERATELY active for at least 30 continuous minutes (OR three continuous 10 minute periods) during your next park visit?
By moderately active we mean doing any physical movement that caused SMALL increases in your breathing or heart rate. Examples would include brisk walking or playing with kids or a dog.

1 = Completely Confident
2 = Very Confident
3 = Confident
4 = Have Some Confidence
5 = Not At All Confident

[If 1 is selected in PA screening item] **During your time in the park today, would you say that you spent any time being VIGOROUSLY active?**
By vigorously active we mean doing any physical movement that caused LARGE increases in your breathing or heart rate. Examples would include running or participating in a sports event like soccer.

1 = Yes
2 = No

[If 1 is selected] **Were you VIGOROUSLY active for at least one continuous 10 minute period?**

1 = Yes
2 = No

[If 1 is selected] **Please tell us how long you were VIGOROUSLY active during your time in the park today.**

1 = Between 10 minutes and 19 minutes of continuous vigorous activity
2 = At least one continuous 20 minute period OR two continuous 10 minute periods of vigorous activity
3 = At least one continuous 30 minute period OR three continuous 10 minute periods of vigorous activity
4 = More than one continuous 30 minute period OR three continuous 10 minute periods of vigorous activity

How confident are you that you could successfully be VIGOROUSLY active for at least 20 continuous minutes (OR two continuous 10 minute periods) during your next park visit?
By vigorously active we mean doing any physical movement that caused LARGE increases in your breathing or heart rate. Examples would include running or participating in a sports event like soccer.

1 = Completely Confident
2 = Very Confident
3 = Confident
4 = Have Some Confidence
5 = Not At All Confident

[If Anacostia Park is selected by data collector] **Please select which of the following activities you did during your visit to Anacostia Park today:**
Select all that apply.

1 = Baseball/Softball
2 = Basketball
3 = Biking
4 = Bird Watching
5 = Boating (sailing, kayaking, canoeing)
6 = Fishing
7 = Flying a Kite
8 = Football
9 = Frisbee
10 = Golfing
33 = Hiking
11 = Handball
12 = Horseback Riding
13 = Laying Down
14 = Picnicking
15 = Playing a Board Game
16 = Playing with Kids
17 = Reading
18 = Roller-blading/Roller-skating
19 = Running/Jogging
20 = Sight Seeing
21 = Sitting
22 = Skateboarding
23 = Soccer
24 = Strength Exercising
25 =Swimming
26 = Tennis
27 = Viewing/Photographing Nature
28 = Volleyball
29 = Walking Briskly
30 = Walking Leisurely
31 = Yoga/Pilates
32 = Other

[If 32 is selected] **Please tell us what other activity/activities you did during your visit to Anacostia Park.**

Fill in

[If Fort Dupont Park is selected by data collector] **Please select which of the following activities you did during your visit to Fort Dupont Park today:**
Select all that apply.

1 = Baseball/Softball
2 = Basketball
3 = Biking
4 = Bird Watching
5 = Boating (sailing, kayaking, canoeing)
6 = Fishing
7 = Flying a Kite
8 = Football
9 = Frisbee
10 = Golfing
33 = Hiking
11 = Handball
12 = Horseback Riding
13 = Laying Down
14 = Picnicking
15 = Playing a Board Game
16 = Playing with Kids
17 = Reading
18 = Roller-blading/Roller-skating
19 = Running/Jogging
20 = Sight Seeing
21 = Sitting
22 = Skateboarding
23 = Soccer
24 = Strength Exercising
25 =Swimming
26 = Tennis
27 = Viewing/Photographing Nature
28 = Volleyball
29 = Walking Briskly
30 = Walking Leisurely
31 = Yoga/Pilates
32 = Other

[If 32 is selected] **Please tell us what other activity/activities you did during your visit to Fort Dupont Park.**
Fill in

[If Rock Creek Park is selected by data collector] **Please select which of the following activities you did during your visit to Rock Creek Park today:**
Select all that apply.

1 = Baseball/Softball
2 = Basketball
3 = Biking
4 = Bird Watching
5 = Boating (sailing, kayaking, canoeing)
6 = Fishing
7 = Flying a Kite
8 = Football
9 = Frisbee
10 = Golfing
33 = Hiking
11 = Handball
12 = Horseback Riding
13 = Laying Down
14 = Picnicking
15 = Playing a Board Game
16 = Playing with Kids
17 = Reading
18 = Roller-blading/Roller-skating
19 = Running/Jogging
20 = Sight Seeing
21 = Sitting
22 = Skateboarding
23 = Soccer
24 = Strength Exercising
25 =Swimming
26 = Tennis
27 = Viewing/Photographing Nature
28 = Volleyball
29 = Walking Briskly
30 = Walking Leisurely
31 = Yoga/Pilates
32 = Other

> [If 32 is selected] **Please tell us what other activity/activities you did during your visit to Rock Creek Park.**
>
> Fill in

[If Anacostia Park is selected by data collector] **To your knowledge, does Anacostia Park have any of the following activity areas? Please check everything that you think it has.**

27 = Amphitheater
1 = Aquatic Gardens
2 = Baseball/Softball Fields
3 = Basketball Courts
27 = Bike Path
25 = Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)
4 = Boardwalk
5 = Boat Center
6 = Exercise Course
7 = Football Field
8 = Golf Course
9 = Handball Courts
28 = Hiking Trail
10 = Historical Sites (for example, a fort, farm or house)
11 = Horse Trails
12 = Ice Skating Rink
13 = Multipurpose Fields (for example, an open grassy area)
14 = Nature Center
15 = Picnic Shelters
16 = Playgrounds
17 = Recreation/Education Center
18 = Skating Pavilion
19 = Soccer Fields
20 = Swimming Pool
21 = Tennis Courts
22 = Track
23 = Volleyball Courts
24 = Walking/Running Trails
26 = Other

> [If 26 is selected] **Please tell us other activity areas that you think are in Anacostia Park.**
>
> Fill in

[If Fort Dupont Park is selected by data collector] **To your knowledge, does Fort Dupont Park have any of the following activity areas? Please check everything that you think it has.**

27 = Amphitheater
1 = Aquatic Gardens
2 = Baseball/Softball Fields

3 = Basketball Courts
27 = Bike Path
25 = Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)
4 = Boardwalk
5 = Boat Center
6 = Exercise Course
7 = Football Field
8 = Golf Course
9 = Handball Courts
28 = Hiking Trail
10 = Historical Sites (for example, a fort, farm or house)
11 = Horse Trails
12 = Ice Skating Rink
13 = Multipurpose Fields (for example, an open grassy area)
14 = Nature Center
15 = Picnic Shelters
16 = Playgrounds
17 = Recreation/Education Center
18 = Skating Pavilion
19 = Soccer Fields
20 = Swimming Pool
21 = Tennis Courts
22 = Track
23 = Volleyball Courts
24 = Walking/Running Trails
26 = Other

> [If 26 is selected] **Please tell us other activity areas that you think are in Fort Dupont Park.**
>
> Fill in

[If Rock Creek Park is selected by data collector] **To your knowledge, does Rock Creek Park have any of the following activity areas? Please check everything that you think it has.**

27 = Amphitheater
1 = Aquatic Gardens
2 = Baseball/Softball Fields
3 = Basketball Courts
27 = Bike Path
25 = Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)
4 = Boardwalk
5 = Boat Center
6 = Exercise Course
7 = Football Field

8 = Golf Course
9 = Handball Courts
28 = Hiking Trail
10 = Historical Sites (for example, a fort, farm or house)
11 = Horse Trails
12 = Ice Skating Rink
13 = Multipurpose Fields (for example, an open grassy area)
14 = Nature Center
15 = Picnic Shelters
16 = Playgrounds
17 = Recreation/Education Center
18 = Skating Pavilion
19 = Soccer Fields
20 = Swimming Pool
21 = Tennis Courts
22 = Track
23 = Volleyball Courts
24 = Walking/Running Trails
26 = Other

> [If 26 is selected] **Please tell us other activity areas that you think are in Rock Creek Park.**
>
> Fill in

[If Anacostia Park is selected by data collector] **Please tell us where you went during your visit to Anacostia Park today:**
Select all that apply.

27 = Amphitheater
1 = Aquatic Gardens
2 = Baseball/Softball Fields
3 = Basketball Courts
27 = Bike Path
25 = Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)
4 = Boardwalk
5 = Boat Center
6 = Exercise Course
7 = Football Field
8 = Golf Course
9 = Handball Courts
28 = Hiking Trail
10 = Historical Sites (for example, a fort, farm or house)
11 = Horse Trails
12 = Ice Skating Rink
13 = Multipurpose Fields (for example, an open grassy area)

14 = Nature Center
15 = Picnic Shelters
16 = Playgrounds
17 = Recreation/Education Center
18 = Skating Pavilion
19 = Soccer Fields
20 = Swimming Pool
21 = Tennis Courts
22 = Track
23 = Volleyball Courts
24 = Walking/Running Trails
26 = Other

> [If 26 is selected] **Please tell us where else you went during your visit to Anacostia Park today.**
>
> Fill in

[If Fort Dupont Park is selected by data collector] **Please tell us where you went during your visit to Fort Dupont Park today:**
Select all that apply.

27 = Amphitheater
1 = Aquatic Gardens
2 = Baseball/Softball Fields
3 = Basketball Courts
27 = Bike Path
25 = Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)
4 = Boardwalk
5 = Boat Center
6 = Exercise Course
7 = Football Field
8 = Golf Course
9 = Handball Courts
28 = Hiking Trail
10 = Historical Sites (for example, a fort, farm or house)
11 = Horse Trails
12 = Ice Skating Rink
13 = Multipurpose Fields (for example, an open grassy area)
14 = Nature Center
15 = Picnic Shelters
16 = Playgrounds
17 = Recreation/Education Center
18 = Skating Pavilion
19 = Soccer Fields
20 = Swimming Pool

21 = Tennis Courts
22 = Track
23 = Volleyball Courts
24 = Walking/Running Trails
26 = Other

[If 26 is selected] **Please tell us where else you went during your visit to Fort Dupont Park today.**

Fill in

[If Rock Creek Park is selected by data collector] **Please tell us where you went during your visit to Rock Creek Park today:**
Select all that apply.

27 = Amphitheater
1 = Aquatic Gardens
2 = Baseball/Softball Fields
3 = Basketball Courts
27 = Bike Path
25 = Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)
4 = Boardwalk
5 = Boat Center
6 = Exercise Course
7 = Football Field
8 = Golf Course
9 = Handball Courts
28 = Hiking Trail
10 = Historical Sites (for example, a fort, farm or house)
11 = Horse Trails
12 = Ice Skating Rink
13 = Multipurpose Fields (for example, an open grassy area)
14 = Nature Center
15 = Picnic Shelters
16 = Playgrounds
17 = Recreation/Education Center
18 = Skating Pavilion
19 = Soccer Fields
20 = Swimming Pool
21 = Tennis Courts
22 = Track
23 = Volleyball Courts
24 = Walking/Running Trails
26 = Other

[If 26 is selected] **Please tell us where else you went during your visit to Rock Creek Park today.**

Fill in

[If Anacostia Park is selected by data collector] **If the following activity areas were available at Anacostia Park, please check any that you would likely use.**
Select all that apply.

27 = Amphitheater
1 = Aquatic Gardens
2 = Baseball/Softball Fields
3 = Basketball Courts
27 = Bike Path
25 = Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)
4 = Boardwalk
5 = Boat Center
6 = Exercise Course
7 = Football Field
8 = Golf Course
9 = Handball Courts
28 = Hiking Trail
10 = Historical Sites (for example, a fort, farm or house)
11 = Horse Trails
12 = Ice Skating Rink
13 = Multipurpose Fields (for example, an open grassy area)
14 = Nature Center
15 = Picnic Shelters
16 = Playgrounds
17 = Recreation/Education Center
18 = Skating Pavilion
19 = Soccer Fields
20 = Swimming Pool
21 = Tennis Courts
22 = Track
23 = Volleyball Courts
24 = Walking/Running Trails
26 = Other
29 = I would not likely use any of these areas

[If 26 is selected] **Please tell us the activity area(s) you would use if they were available at Anacostia Park.**

Fill in

[If Fort Dupont Park is selected by data collector] **If the following activity areas were available at Fort Dupont Park, please check any that you would likely use.**
Select all that apply.

27 = Amphitheater
1 = Aquatic Gardens
2 = Baseball/Softball Fields
3 = Basketball Courts
27 = Bike Path
25 = Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)
4 = Boardwalk
5 = Boat Center
6 = Exercise Course
7 = Football Field
8 = Golf Course
9 = Handball Courts
28 = Hiking Trail
10 = Historical Sites (for example, a fort, farm or house)
11 = Horse Trails
12 = Ice Skating Rink
13 = Multipurpose Fields (for example, an open grassy area)
14 = Nature Center
15 = Picnic Shelters
16 = Playgrounds
17 = Recreation/Education Center
18 = Skating Pavilion
19 = Soccer Fields
20 = Swimming Pool
21 = Tennis Courts
22 = Track
23 = Volleyball Courts
24 = Walking/Running Trails
26 = Other
29 = I would not likely use any of these areas

> [If 26 is selected] **Please tell us the activity area(s) you would use if they were available at Fort Dupont Park.**
>
> Fill in

[If Rock Creek Park is selected by data collector] **If the following activity areas were available at Rock Creek Park, please check any that you would likely use.**
Select all that apply.

27 = Amphitheater
1 = Aquatic Gardens

2 = Baseball/Softball Fields
3 = Basketball Courts
27 = Bike Path
25 = Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)
4 = Boardwalk
5 = Boat Center
6 = Exercise Course
7 = Football Field
8 = Golf Course
9 = Handball Courts
28 = Hiking Trail
10 = Historical Sites (for example, a fort, farm or house)
11 = Horse Trails
12 = Ice Skating Rink
13 = Multipurpose Fields (for example, an open grassy area)
14 = Nature Center
15 = Picnic Shelters
16 = Playgrounds
17 = Recreation/Education Center
18 = Skating Pavilion
19 = Soccer Fields
20 = Swimming Pool
21 = Tennis Courts
22 = Track
23 = Volleyball Courts
24 = Walking/Running Trails
26 = Other
29 = I would not likely use any of these areas

[If 26 is selected] **Please tell us the activity area(s) you would use if they were available at Rock Creek Park.**

Fill in

If you had been more physically active during your park visit today, how likely is it that you would have been injured?

1 = Extremely Likely
2 = Likely
3 = Neutral
4 = Unlikely
5 = Extremely Unlikely

If you had been more physically active during your park visit today, how likely is it that you would have felt better physically?

1 = Extremely Likely
2 = Likely
3 = Neutral
4 = Unlikely
5 = Extremely Unlikely

If you had been more physically active during your park visit today, how likely is it that you would have experienced pain?

1 = Extremely Likely
2 = Likely
3 = Neutral
4 = Unlikely
5 = Extremely Unlikely

If you had been more physically active during your park visit today, how likely is it that you would have felt a sense of personal accomplishment?

1 = Extremely Likely
2 = Likely
3 = Neutral
4 = Unlikely
5 = Extremely Unlikely

How much do you agree or disagree with the following statement. The trails/paths were in good repair during my park visit today.
For example, there weren't any potholes.

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree
6 = I did not use any trails/paths during my park visit today.

How much do you agree or disagree with the following statement. The park was clean during my park visit today.

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree

How much do you agree or disagree with the following statement. Park facilities were in good repair during my park visit today.
For example, the toilets worked.

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree
6 = I did not use any park facilities during my visit today.

How much do you agree or disagree with the following statement. There were too many people during my park visit today.

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree

How much do you agree or disagree with the following statement. I was afraid of theft during my park visit today.
For example, you thought someone might steal your phone or wallet.

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree

How much do you agree or disagree with the following statement. I was afraid of racial/ethnic conflict during my park visit today.

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree

How much do you agree or disagree with the following statement. I was afraid there would be any dogs off their leash during my park visit today.

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree

How much do you agree or disagree with the following statement. I felt unwelcome by other park visitors during my park visit today.

1 = Strongly Agree
2 = Agree
3 = Neither Agree or Disagree
4 = Disagree
5 = Strongly Disagree

Are there ways that this park could increase your level of physical activity on a future visit?

Fill in

Our last set of questions will help us describe the group of people who took part in our survey.
Please continue.

What is your age?

Fill in

What is your gender?

1 = Male
2 = Female

Are you Hispanic or Latino?

1 = Yes
2 = No

Which of the following would you say is your race?
You may check more than one answer.

1 = White
2 = Black or African American
3 = Asian
4 = Native Hawaiian or Other Pacific Islander
5 = American Indian or Alaska Native
6 = Other

[If 6 is selected] **Please tell us your race:**

Fill in

Which of the following height categories do you fit in (without any shoes on):

1= 3'11 (three feet, eleven inches) or Less
2= Between 4'0 (four feet) and 4'11 (four feet, eleven inches)
3= Between 5'0 (five feet) and 5'11 (five feet, eleven inches)
4= Between 6'0 (six feet) and 6'11 (six feet, eleven inches)
5= Between 7'0 (seven feet) and 7'11 (seven feet, eleven inches)
6= 8'0 (eight feet) or More

[If 1 is selected] **Now please tell us your exact height (to the nearest inch):** Please use inches (in) only.

Fill in

[If 2 is selected] **Now please tell us your exact height (to the nearest inch):**

1= 4'0 (four feet)
2= 4'1 (four feet, one inch)
3= 4'2 (four feet, two inches)
4= 4'3 (four feet, three inches)
5= 4'4 (four feet, four inches)
6= 4'5 (four feet, five inches)
7= 4'6 (four feet, six inches)
8= 4'7 (four feet, seven inches)
9= 4'8 (four feet, eight inches)
10= 4'9 (four feet, nine inches)
11= 4'10 (four feet, ten inches)
12= 4'11 (four feet, eleven inches)

[If 3 is selected] **Now please tell us your exact height (to the nearest inch):**

1= 5'0 (five feet)
2= 5'1 (five feet, one inch)
3= 5'2 (five feet, two inches)
4= 5'3 (five feet, three inches)
5= 5'4 (five feet, four inches)
6= 5'5 (five feet, five inches)
7= 5'6 (five feet, six inches)
8= 5'7 (five feet, seven inches)
9= 5'8 (five feet, eight inches)
10= 5'9 (five feet, nine inches)
11= 5'10 (five feet, ten inches)
12= 5'11 (five feet, eleven inches)

[If 4 is selected] **Now please tell us your exact height (to the nearest inch):**

1= 6'0 (six feet)
2= 6'1 (six feet, one inch)
3= 6'2 (six feet, two inches)
4= 6'3 (six feet, three inches)
5= 6'4 (six feet, four inches)
6= 6'5 (six feet, five inches)
7= 6'6 (six feet, six inches)
8= 6'7 (six feet, seven inches)
9= 6'8 (six feet, eight inches)
10= 6'9 (six feet, nine inches)
11= 6'10 (six feet, ten inches)
12= 6'11 (six feet, eleven inches)

[If 5 is selected] **Now please tell us your exact height (to the nearest inch):**

1= 7'0 (seven feet)
2= 7'1 (seven feet, one inch)
3= 7'2 (seven feet, two inches)
4= 7'3 (seven feet, three inches)
5= 7'4 (seven feet, four inches)
6= 7'5 (seven feet, five inches)
7= 7'6 (seven feet, six inches)
8= 7'7 (seven feet, seven inches)
9= 7'8 (seven feet, eight inches)
10= 7'9 (seven feet, nine inches)
11= 7'10 (seven feet, ten inches)
12= 7'11 (seven feet, eleven inches)

[If 6 is selected] **Now please tell us your exact height (to the nearest inch):**
Please use inches (in) only.

Fill in

About how much do you weigh without shoes?

Fill in

Would you say that in general your health is:

1 = Excellent
2 = Very Good
3 = Good
4 = Fair
5 = Poor

Has a doctor, nurse or other health professional EVER told you that you have a chronic illness or ongoing condition, such as diabetes, asthma or heart disease?

1 = Yes
2 = No
3 = Not Sure

What is the highest level of formal education you have completed?

1 = Less than high school
2 = High School or GED
3 = Some College
4 = Two-Year College Degree
5 = Four-Year College Degree
6 = Advanced Degree

What is your annual household income from all sources before taxes?

1 = Less than $25,000
2 = $25,000-$49,000
3 = $50,000-$74,999
4 = $75,000-$99,999
5 = $100,000-$149,000
6 = $150,000-$199,999
7 = $200,000 or more

Are you…?

1 = Married
2 = Divorced
3 = Widowed
4 = Separated
5 = Never Married

Are there any children less than 18 years of age that live your household?

1 = Yes
2 = No

> [If 1 is selected] **How many children less than 18 years of age live in your household?**
>
> Fill in

Are you currently…?

1 = Employed for wage
2 = Self-employed

3 = Out of work more than 1 year
4 = Out of work less than 1 year
5 = A Homemaker
6 = A Student
7 = Retired

Will you please provide us with your 5-digit zip code?
This information will help us know where people are coming from to use this park. All data will be kept confidential.

Fill in

Thank you for completing this survey. Please let the research team know you are done so you can receive your compensation.

Items To Be Completed By Data Collector After Device Is Handed Back To Research Team:

Item	Values
Time Survey Completed:	HH:MM [AM or PM]
Data Collector:	1 = JR 2 = AA 3 = MP 4 = JL 5 = Other
[If 5 is selected] Specify Data Collector Initials:	Fill in
Accelerometer participant?	1 = Yes 2 = No
[If 1 is selected] Accelerometer Device ID	Fill in
[If 1 is selected] Accelerometer Step Count:	Continuous
[If 1 is selected] Accelerometer Distance:	Continuous
[If 1 is selected] Accelerometer Activity Minutes:	Continuous
Temperature	Continuous
Relative Humidity	Continuous
Wet Bulb Temperature	Continuous
Dew Point	Continuous
Air Quality Index (AQI)	Continuous

B. INFORMATION SHEETS

1. **Cognitive Interview**
2. **Survey Component**
3. **Validation Component**

1. Information Sheet - Cognitive Interview

UNIFORMED SERVICES UNIVERSITY
of the Health Sciences

INFORMATION SHEET

1. INTRODUCTION OF THE STUDY

You are being asked to be in a research study entitled, "Factors that are Associated with Physical Activity Among Visitors to Urban National Parks: Are There Group Differences?" This study is being carried out by the Uniformed Services University of the Health Sciences (USUHS), which is located in Bethesda, Maryland. The data that will be collected is anonymous, which means it cannot be traced back to you. This information sheet provides information about the research study. Once you understand the study, you can decide if you want to take part in this research. Your decision is voluntary. This means you are free to choose if you want to take part in this study. By completing the questionnaire, you have consented to participate in this study.

2. PURPOSE AND PROCEDURES

The purpose of this study is to find out about the activities and opinions of visitors to parks in Washington D.C. This will help us learn about what visitors do in the park and how they make such decisions. We will also explore if there are any differences between what groups of people tell us, for example, by gender, age, race/ethnicity, etc. These findings will help us create recommendations for possible changes within the park. Juleon Rabbani, a graduate student in USUHS' Department of Preventive Medicine, is directing this research project.

We have drafted a questionnaire but we want to test it with a few volunteers before actually having hundreds of people take it. You will be asked to read and answer the questions, and then talk us through how you decided to choose the answer you did. This will help us learn whether the questions we have written are clear.

We hope to test this questionnaire with 5 volunteers. It should take you about one hour to help with this process.

3. POSSIBLE BENEFITS FROM BEING IN THIS STUDY

There will be no direct benefit to you from participating in this research.

4. COMPENSATION

The payment for taking part in an interview is a Target gift card in the amount of $25.

5. ALTERNATIVE PROCEDURES/TREATMENT

The alternative to participating in this study is not participating.

6. POSSIBLE RISKS OR DISCOMFORTS FROM BEING IN THIS STUDY

There are no expected risks or discomforts from being in this study. You may skip any questions that you do not want to answer.

7. RIGHT TO WITHDRAW

You may decide to stop taking part in the study at any time. Your relations with USUHS, if any, will not be changed in any way if you decide to end your participation in the study.

8. RECOURSE IN THE EVENT OF INJURY

If at any time you believe you have suffered an injury or illness as a result of participating in this research project, you should contact the Director of Human Research Protections Programs at the Uniformed Services University of the Health Sciences, Bethesda, Maryland 20814-4799 at (301) 295-9534. This office can review the matter with you, can provide information about your rights as a subject, and may be able to identify resources available to you. If you believe the government or one of the government's employees (such as a military doctor) has injured you, a claim for damages (money) against the federal government (including the military) may be filed under the Federal Torts Claims Act. Information about judicial avenues of compensation is available from the University's General Counsel at (301) 295-3028.

9. PRIVACY AND CONFIDENTIALITY

All information you provide as part of this study will be confidential and will be protected to the fullest extent provided by law. The only information we plan to keep from this interview relates to your interpretation of our questions. Your opinion of our question wording and other records related to this study will be kept in a locked cabinet in the private office of the principal investigator’s advisor, which is located at the Uniformed Services University of the Health Sciences. All records related to this study will be accessible to those persons directly involved in conducting this study and members of the USUHS Institutional Review Board (IRB), which provides oversight for protection of human research volunteers. In addition, the IRB at USUHS and other federal agencies that help protect people who are involved in research studies may need to see the information you give us. Other than those groups, records from this study will be kept private to the fullest extent of the law. Scientific reports that come out of this

study will not use your name or identify you in any way. If you are a military member, please be advised that under Federal Law, a military member's confidentiality cannot be strictly guaranteed.

You will be asked to sign a receipt confirming that you received a gift card from the study team. That information is required by our Finance Department, because the card has a monetary value. The investigators working on this study will not keep a record of your name and it will never be linked to the data you provide for this research.

10. CONTACT FOR QUESTIONS OR PROBLEMS

If you have questions about this research, you should contact Juleon Rabbani of USUHS, Bethesda, Maryland 20814. His number is (323) 863-6040. Even in the evening or on weekends, you can leave a message at that number. If you have questions about your rights as a research subject, you should call the Director of Human Research Protections Programs at USUHS at (301) 295-9534. She is your representative and has no connection to the researcher conducting this study.

IF YOU HAVE ANY QUESTIONS PLEASE FEEL FREE TO ASK THEM

Completion of this questionnaire indicates that you understand the nature of the study and volunteer to participate in it. You attest that you meet the requirements for participation in this study. You understand that the study is designed for research purposes and not to be of direct benefit to you.

2. Information Sheet – Survey Component

UNIFORMED SERVICES UNIVERSITY
of the Health Sciences

INFORMATION SHEET

1. INTRODUCTION OF THE STUDY

You are being asked to be in a research study entitled, "Factors that are Associated with Physical Activity Among Visitors to Urban National Parks: Are There Group Differences?" This study is being carried out by the Uniformed Services University of the Health Sciences (USUHS), which is located in Bethesda, Maryland. The data that will be collected is anonymous, which means it cannot be traced back to you. This information sheet provides information about the research study. Once you understand the study, you can decide if you want to take part in this research. Your decision is voluntary. This means you are free to choose if you want to take part in this study. By completing the questionnaire, you have consented to participate in this study.

2. PURPOSE AND PROCEDURES

The purpose of this study is to find out about the activities and opinions of visitors to parks in Washington D.C. This will help us learn about what visitors do in the park and how they make such decisions. We will also explore if there are any differences between what groups of people tell us, for example by gender, age, race/ethnicity, etc. These findings will help us create recommendations for possible changes within the park. Juleon Rabbani, a graduate student in USUHS' Department of Preventive Medicine, is directing this research project.

It will take you approximately 10 minutes to complete the questionnaire. Once you have completed the questionnaire, you will need to return the data collection device to a team member. No personally identifying information will be requested or recorded.

3. POSSIBLE BENEFITS FROM BEING IN THIS STUDY

There will be no direct benefit to you from participating in this research.

4. COMPENSATION

Volunteers will be offered a bottle of water for filling out the questionnaire.

5. ALTERNATIVE PROCEDURES/TREATMENT

The alternative to participating in this study is not participating.

6. POSSIBLE RISKS OR DISCOMFORTS FROM BEING IN THIS STUDY

There are no expected risks or discomforts from being in this study. You may skip any questions that you do not want to answer.

7. RIGHT TO WITHDRAW

You may decide to stop taking part in the study at any time. Your relations with USUHS, if any, will not be changed in any way if you decide to end your participation in the study.

8. RECOURSE IN THE EVENT OF INJURY

If at any time you believe you have suffered an injury or illness as a result of participating in this research project, you should contact the Director of Human Research Protections Programs at the Uniformed Services University of the Health Sciences, Bethesda, Maryland 20814-4799 at (301) 295-9534. This office can review the matter with you, can provide information about your rights as a subject, and may be able to identify resources available to you. If you believe the government or one of the government's employees (such as a military doctor) has injured you, a claim for damages (money) against the federal government (including the military) may be filed under the Federal Torts Claims Act. Information about judicial avenues of compensation is available from the University's General Counsel at (301) 295-3028.

9. PRIVACY AND CONFIDENTIALITY

All information you provide as part of this study will be confidential and will be protected to the fullest extent provided by law. Your responses to our questionnaire will be maintained in a password-protected folder on the principal investigator’s computer in a locked residence. All records related to this study will be accessible to those persons directly involved in conducting this study and members of the USUHS Institutional Review Board (IRB), which provides oversight for protection of human research volunteers. In addition, the IRB at USUHS and other federal agencies that help protect people who are involved in research studies may need to see the information you give us. Other than those groups, records from this study will be kept private to the fullest extent of the law. Scientific reports that come out of this study will not use your name or identify you in any way. If you are a military member, please be advised that under Federal Law, a military member's confidentiality cannot be strictly guaranteed.

10. CONTACT FOR QUESTIONS OR PROBLEMS

If you have questions about this research, you should contact Juleon Rabbani of USUHS,

Bethesda, Maryland 20814. His number is (323) 863-6040. Even in the evening or on weekends, you can leave a message at that number. If you have questions about your rights as a research subject, you should call the Director of Human Research Protections Programs at USUHS at (301) 295-9534. She is your representative and has no connection to the researcher conducting this study.

IF YOU HAVE ANY QUESTIONS PLEASE FEEL FREE TO ASK THEM

Completion of this questionnaire indicates that you understand the nature of the study and volunteer to participate in it. You attest that you meet the requirements for participation in this study. You understand that the study is designed for research purposes and not to be of direct benefit to you.

3. Information Sheet – Validation Component

UNIFORMED SERVICES UNIVERSITY
of the Health Sciences

INFORMATION SHEET

1. INTRODUCTION OF THE STUDY

You are being asked to be in a research study entitled, "Factors that are Associated with Physical Activity Among Visitors to Urban National Parks: Are There Group Differences?" This study is being carried out by the Uniformed Services University of the Health Sciences (USUHS), which is located in Bethesda, Maryland. The data that will be collected is anonymous, which means it cannot be traced back to you. This information sheet provides information about the research study. Once you understand the study, you can decide if you want to take part in this research. Your decision is voluntary. This means you are free to choose if you want to take part in this study. By wearing our accelerometer during your park visit, as well as completing and submitting the questionnaire, you have consented to participate in this study. An accelerometer is a device that measures your activity levels.

2. PURPOSE AND PROCEDURES

The purpose of this study is to find out about the activities and opinions of visitors to parks in Washington D.C. This will help us learn about what visitors do in the park and how they make such decisions. We will also explore if there are any differences between what groups of people tell us, for example by gender, age, race/ethnicity, etc. These findings will help us create recommendations for possible changes within the park. Juleon Rabbani, a graduate student in USUHS' Department of Preventive Medicine, is directing this research project. We are asking volunteers to do two things: wear an accelerometer during their park visit and fill out a questionnaire at the end of their park visit.

By wearing an accelerometer during your park visit, you will help us understand activity levels of park visitors. The questionnaire will help us learn about what visitors do in the park and how they make such decisions, and create recommendations for possible changes within the park. You will be asked to clip an accelerometer to your waistband during your entire park visit. At the end of your visit, you will be asked to return the accelerometer to a team member and fill out a questionnaire that will take you approximately 10 minutes to complete. Once you have completed the questionnaire, you will need to return the data collection device to a team member. No personally identifying information will be requested or recorded.

3. POSSIBLE BENEFITS FROM BEING IN THIS STUDY

There will be no direct benefit to you from participating in this research.

4. COMPENSATION

The payment for wearing the accelerometer and filling out the questionnaire is a CVS gift card in the amount of $10 and a bottle of water.

5. ALTERNATIVE PROCEDURES/TREATMENT

The alternative to participating in this study is not participating.

6. POSSIBLE RISKS OR DISCOMFORTS FROM BEING IN THIS STUDY

There are no expected risks or discomforts from being in this study. You may skip any questions that you do not want to answer.

7. RIGHT TO WITHDRAW

You may decide to stop taking part in the study at any time. Your relations with USUHS, if any, will not be changed in any way if you decide to end your participation in the study.

8. RECOURSE IN THE EVENT OF INJURY

If at any time you believe you have suffered an injury or illness as a result of participating in this research project, you should contact the Director of Human Research Protections Programs at the Uniformed Services University of the Health Sciences, Bethesda, Maryland 20814-4799 at (301) 295-9534. This office can review the matter with you, can provide information about your rights as a subject, and may be able to identify resources available to you. If you believe the government or one of the government's employees (such as a military doctor) has injured you, a claim for damages (money) against the federal government (including the military) may be filed under the Federal Torts Claims Act. Information about judicial avenues of compensation is available from the University's General Counsel at (301) 295-3028.

9. PRIVACY AND CONFIDENTIALITY

All information you provide as part of this study will be confidential and will be protected to the fullest extent provided by law. Your accelerometer measurements and responses to our questionnaire will be maintained in a password-protected folder on the principal investigator’s computer in a locked residence. All records related to this study

will be accessible to those persons directly involved in conducting this study and members of the USUHS Institutional Review Board (IRB), which provides oversight for protection of human research volunteers. In addition, the IRB at USUHS and other federal agencies that help protect people who are involved in research studies may need to see the information you give us. Other than those groups, records from this study will be kept private to the fullest extent of the law. Scientific reports that come out of this study will not use your name or identify you in any way. If you are a military member, please be advised that under Federal Law, a military member's confidentiality cannot be strictly guaranteed.

You will be asked to sign a receipt confirming that you received a gift card from the study team. That information is required by our Finance Department, because the card has a monetary value. The investigators working on this study will not keep a record of your name and it will never be linked to the data you provide for this research.

10. CONTACT FOR QUESTIONS OR PROBLEMS

If you have questions about this research, you should contact Juleon Rabbani of USUHS, Bethesda, Maryland 20814. His number is (323) 863-6040. Even in the evening or on weekends, you can leave a message at that number. If you have questions about your rights as a research subject, you should call the Director of Human Research Protections Programs at USUHS at (301) 295-9534. She is your representative and has no connection to the researcher conducting this study.

IF YOU HAVE ANY QUESTIONS PLEASE FEEL FREE TO ASK THEM

Wearing an accelerometer during your park visit and completion of the questionnaire indicates that you understand the nature of the study and volunteer to participate in it. You attest that you meet the requirements for participation in this study. You understand that the study is designed for research purposes and not to be of direct benefit to you.

C. VERBAL CONSENT SCRIPTS

Survey Component:

As visitors EXITED a park, a data collector using the approved recruitment procedures stated:

Hello, I am part of a research team from the Uniformed Services University that is doing a study about visitor activities and opinions in this park. We will also explore if there are any differences between what groups of people tell us. This anonymous survey will take about 10 minutes to fill out. Your participation is entirely voluntary. If you would like to take part in this study, I will go over what you need to do to fill it out. If you help us out, we will show our appreciation by offering you a bottle of water.

If visitor agreed: *Thanks – let's get started.* [Provided information sheet for further information and data collection device, then showed participant how to operate it]

If visitor declined: *Thanks anyway – I hope you enjoyed your park visit today.* [No effort was be made to change their mind]

Validation Component:

As visitors ENTERED a park, a data collector, using the approved recruitment procedures, approached every 10th visitor and stated:

Hello, I am part of a research study that is collecting information on visitor activities and opinions in this park. We will also explore if there are any differences between what groups of people tell us. Can you tell me about how long you think you will be at the park today?

- For those who indicated they would be in the park longer than the data collection period: *Well that is later than we will be here today. Thanks anyway for stopping.*
- For those who indicated they would be in the park during the data collection period: *Great. Do you think you'll spend anytime in the water (like in the pool or river) during your visit today?*
    - If yes: *Well our study involves the use of electronics that aren't waterproof. Thanks anyway for stopping.*
    - If no: *We are asking a random mix of visitors to wear this accelerometer during their visit. Those who agree will also be asked to fill out a 10 minute survey when they leave the park. If you help us out, we will show our appreciation by offering you a $10 Target gift card, along with a bottle of water.*
        - If they asked why they needed to wear the accelerometer: *It is to help us understand how people use the park when they are here.*

This is a research study, and participation is voluntary. We will not be asking for your name or other identifying information. This study is being carried out by the Uniformed Services University. Would you be willing to help us out?

- No: *Well I understand, enjoy your visit.* [No effort was be made to change their mind]
- Yes: *Great, thank you. I will show you how to put the accelerometer on myself and then you can try. And don't forget to stop by here again on your way out of the park. We will need to collect some information from the accelerometer and ask you to fill out that short survey. Thanks again.* [Provided information sheet]

  After visit:

  Thanks again for helping us out. Let me tell you how to fill out the survey.

[Provided data collection device and showed participant how to operate it]

D. GUIDE TO STUDY VARIABLES

Table 11: Guide to Study Variables

Dependent Variable

Variable/Construct	# Items	Answer Choices/Scale	Coding
Active/Non-Active Park Visit			
Park-based Physical Activity	1	Yes or No	Categorical (nominal); 0 = no; 1= yes

Independent Variables

Variable/Construct	# Items	Answer Choices/Scale	Coding
Self-Efficacy	2	5-point Likert scale (1= not confident-5=extremely confident)	Categorical (ordinal); each item scored separately; higher # indicates higher self-efficacy
Self-Regulation	2	Yes or No	Categorical (ordinal); no to 1st item = 0; Yes to 1st item, no to 2nd item = 1; Yes to both items = 3; higher # indicates higher self-regulation
Outcome-Expectancy	4	5-point Likert scale (1= extremely unlikely-5= extremely likely)	Continuous; composite Score = mean score of 4 items; reverse code negative items; higher # indicates visitors feel positive outcomes may happen
Social Support			
Group Composition	2	Yes or No; List of group type	Categorical (nominal); alone = 0; any additional group member = 1
General PA Support	1-4	5-point Likert scale (1= strongly disagree-5= strongly agree)	Categorical (ordinal); each item scored separately; higher # indicates higher social support
Number of Adults/Children in Group	2	Integer (fill-in)	Categorical (nominal); any children (yes/no); any adults (yes/no)
Health Indicators			

Body Mass Index	2	Height, weight	Categorical (nominal); 0= Underweight (BMI<18.5), 1= Normal Weight (BMI 18.5-24.9), 2= Overweight (BMI 25-30), 3= Obese (BMI>30)
Chronic Illness	1	Yes, No, Not Sure	Categorical (nominal); 0= no; 1= yes; 9=not sure
General Health Status	1	Poor, fair, good, very good, excellent	Categorical (ordinal); 1= poor; 2= fair; 3= good; 4= very good; 5=excellent; higher score indicates greater general health
Perceived Social Environment			
Social Situations	5	5-point Likert scale (1= strongly disagree-5= strongly agree)	Categorical (ordinal); each item scored separately; higher # indicates higher level of agreement
Activity Participation	1	List of activities in park	Categorical (nominal); for each activity: 0=did not participate; 1= did participate
Perceived Physical Environment			
Aesthetics/Conditions	3	5-point Likert scale (1= strongly disagree-5= strongly agree)	Categorical (ordinal); each item scored separately; higher # indicates higher level of agreement
Activity Areas Used	1	List of activities in park	Categorical (nominal); for each activity area: 0=did not use; 1= used
Desired Activity Areas	1	List of potential activities in park	Categorical (nominal); for each activity area: 0=not desired; 1= desired
Proximity	1	Zip code (fill-in)	Continuous; general spatial distance (miles) between zip code and respective park will be calculated

Mode of Transport	1	Car, bus, metro, biked, walked, ran/jogged, other	Categorical (nominal); 0= car; 1= bus; 2= metro; 3= biked; 4= walked; 5= ran/jogged; 6= other
Weather			
Temperature	1	Fahrenheit; recorded by data collector	Continuous; record at end of visit
Dew Point	1	Fahrenheit; recorded by data collector	Continuous; record at end of visit
Relative Humidity	1	Fahrenheit; recorded by data collector	Continuous; record at end of visit
Wet-Bulb Temperature	1	Fahrenheit; recorded by data collector	Continuous; record at end of visit
Day of Week	1	Days of the week; recorded by data collector	Categorical (nominal); 0= Sunday; 1= Monday; 2= Tuesday; 3= Wednesday; 4= Thursday; 5= Friday; 6= Saturday
Time of Day	1	Morning (8am-11am), afternoon (12pm-3pm) and evening (5pm-8pm); recorded by data collector	Categorical (nominal); 0 = morning; 1= afternoon; 2= evening
Sociodemographics			
Race/ethnicity	2	Hispanic (yes/no); race (White, Black or African American, Other (Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, Other)	Categorical (nominal); non-Hispanic African American; non-Hispanic White; other categories depending on sample
Age	1	Integer (fill-in)	Continuous
Gender	1	Male or Female	Categorical (nominal); 0= female; 1= male
Educational Level	1	Less than high school, high school/GED, some college, 2-year college degree, 4-year college degree, advanced degree	Categorical (nominal); 0= Less than high school; 1= high school/GED; 2= some college; 3= 2-year college degree; 4= 4-year college degree; 5= advanced degree
Income	1	Less than $25,000, $25,000-$49,000, $50,000-$74,999,	Categorical (nominal); 0= less than $25,000; 1= $25,000-$49,000; 2=

		$75,000-$99,999, $100,000-$149,000, $150,000-$199,999, $200,000 or more	$50,000-$74,999; 3= $75,000-$99,999 4= $100,000-$149,000; 5= $150,000-$199,999; 6= $200,000 or more
Employment Status	1	Employed for wages, self-employed, out of work less than 1 year, out of work more than 1 year, homemaker, student, retired	Categorical (nominal); 0 = not employed (out of work less than 1 year, out of work more than 1 year, homemaker, student, retired); 1 = employed (employed for wages, self-employed)
Marital Status	1	Married, never married, divorced, widowed, separated, member of an unmarried couple	Categorical (nominal); 0 = not married (never married, divorced, widowed, separated, member of an unmarried couple); 1= married
Children in Household	1	Integer (fill-in)	Categorical (nominal); 0 = no children in household; 1 = children in the household (1 or more)

E. Selection of Park Sites – Procedures and Spatial Analysis

Using ArcGIS 10, several steps were taken to systematically select park sites for visitor recruitment in Washington, D.C. After importing a national-level shapefile[3] with pre-joined demographic data (e.g. total population, total housing units, median age, race/ethnicity) organized by census tracts from the 2010 U.S. Census (104), we first eliminated data outside of the National Capital region with the Clip function (this reduces the processing load of intended analyses by excluding unnecessary data from other regions). We then adjusted the symbology of the map to display quantities, in graduated colors, of total Black or African American population as a percentage of the total population. This was done by normalizing total Black or African American population by the 'population of one race' variable and creating 10 equal percentage intervals. Next, boundaries of national park sites were overlaid onto the demographic layer (77). After examining the type of sites displayed on the map, we then excluded several non-recreational areas. Editing the attribute table from the park boundary layer, we excluded sites with the following terms: parkway, parking, plaza, circle, National Mall and house. These areas are operated by the NPS but offer little to no opportunity for PA.

We then created 0.5 mile buffer polygons around each of the remaining park sites. This distance is used in the literature to represent how far people can be expected to walk for park use in urban areas (29; 97). In one study that investigated both observed visitors and local area residents around 8 urban community parks in Los Angeles (30), 64% of observed visitors lived within 0.5 miles of a park. Only 13% of observed visitors lived

[3] A shapefile is a commonly used file-based format in spatial analysis. It stores information on points, lines and polygons in separate layers.

more than 1 mile away from a park, highlighting the importance of proximity to park use. Among area residents living within 0.5 miles of a park, only 19% reported being infrequent park visitors (compared to 38% among those who lived more than a mile away). Perhaps more importantly, residents that reported living within 0.5 miles of a park were more likely to report exercising 5 or more times per week in a park than those living farther than 1 mile away.

After intersecting these buffer polygons with U.S. census tracts, we were able to pinpoint park sites that were within 0.5 miles of a census tract that had at least a 95% African American total population. Historically, investigators have had difficulty obtaining an adequate proportion of African Americans in their samples (Mowen et al 2012; Wilhelm et al 2009) because they tend to be underrepresented in parks. We chose to use 95% as a cut-off point to improve the likelihood of capturing a sample of African Americans that adequately powers our study.

We further excluded recruitment sites that were not contiguous (versus an amalgam of separate sites technically designated a "park") to better facilitate a feasible sampling scheme. Using information from NPS websites and field visits to prospective recruitment sites, we also excluded parks that did not offer a range of activity areas that could accommodate all PA levels (non-active, moderate or vigorous; see Table 12).

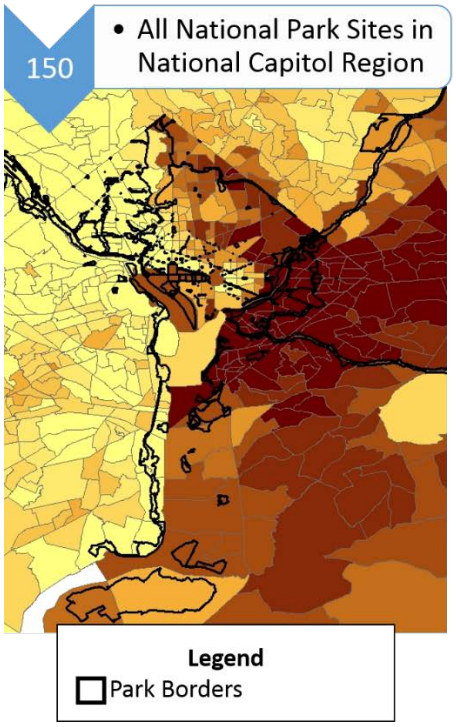
Table 12: Activity Areas by Study Recruitment Site

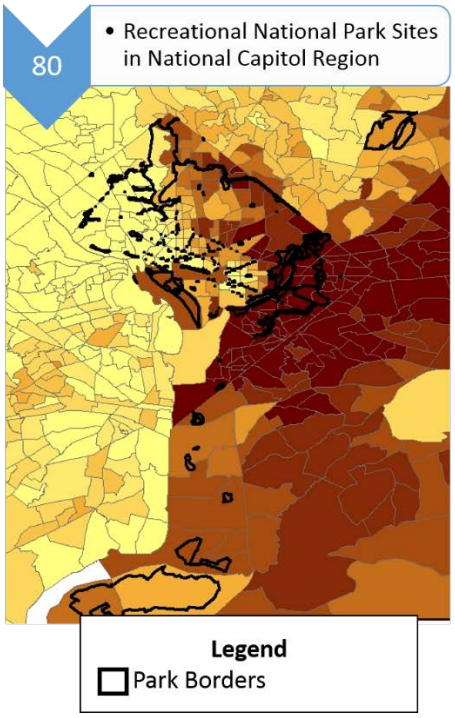
Park Name	Anacostia	Fort Davis	Fort Dupont	Fort Stanton
Trails	X		X	X
Picnic Shelters	X		X	
Multipurpose Fields	X	X	X	X
Basketball Courts	X	X	X	X
Ballfield	X	X	X	X
Tennis Courts	X	X	X	X
Waterways	X			
Swimming Pool	X			
Playground	X	X		X
Recreation Center		X	X	X
Skating Pavilion	X			

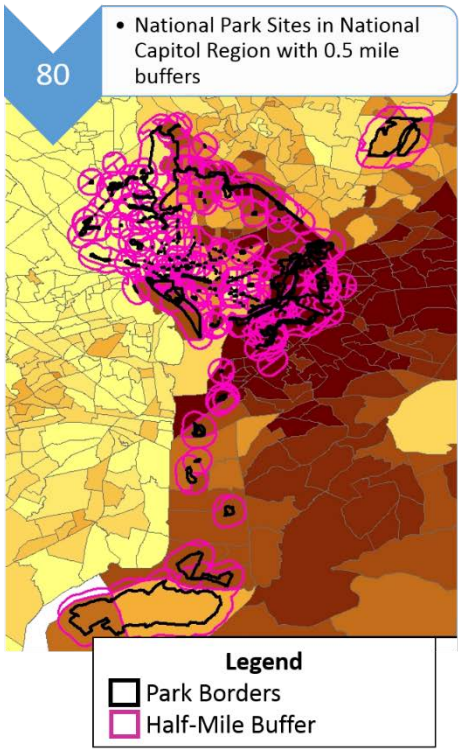
*Checked = a park feature, Unchecked = not a park feature

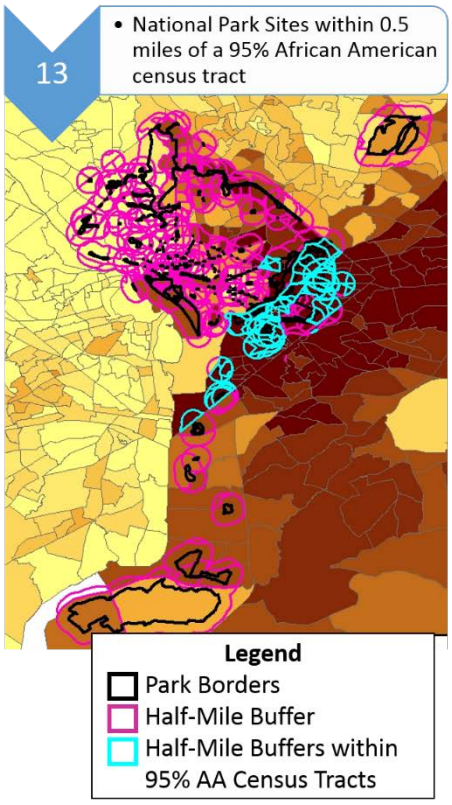
Figure 6 provides a visual representation of the previously described steps. Darker colors in the demographic (background) layer represent a higher percentage of African Americans within the total population of each census tract.

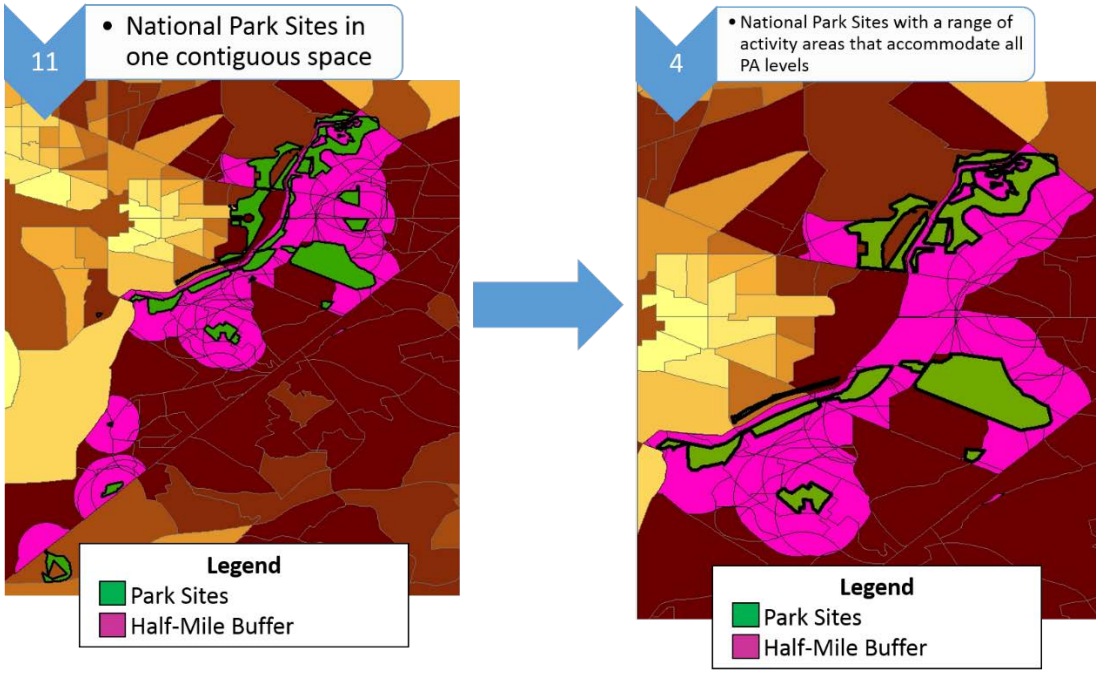
Figure 6: Park Site Selection through Spatial Analysis


150
• All National Park Sites in National Capitol Region
Legend
Park Borders


80
• Recreational National Park Sites in National Capitol Region
Legend
Park Borders

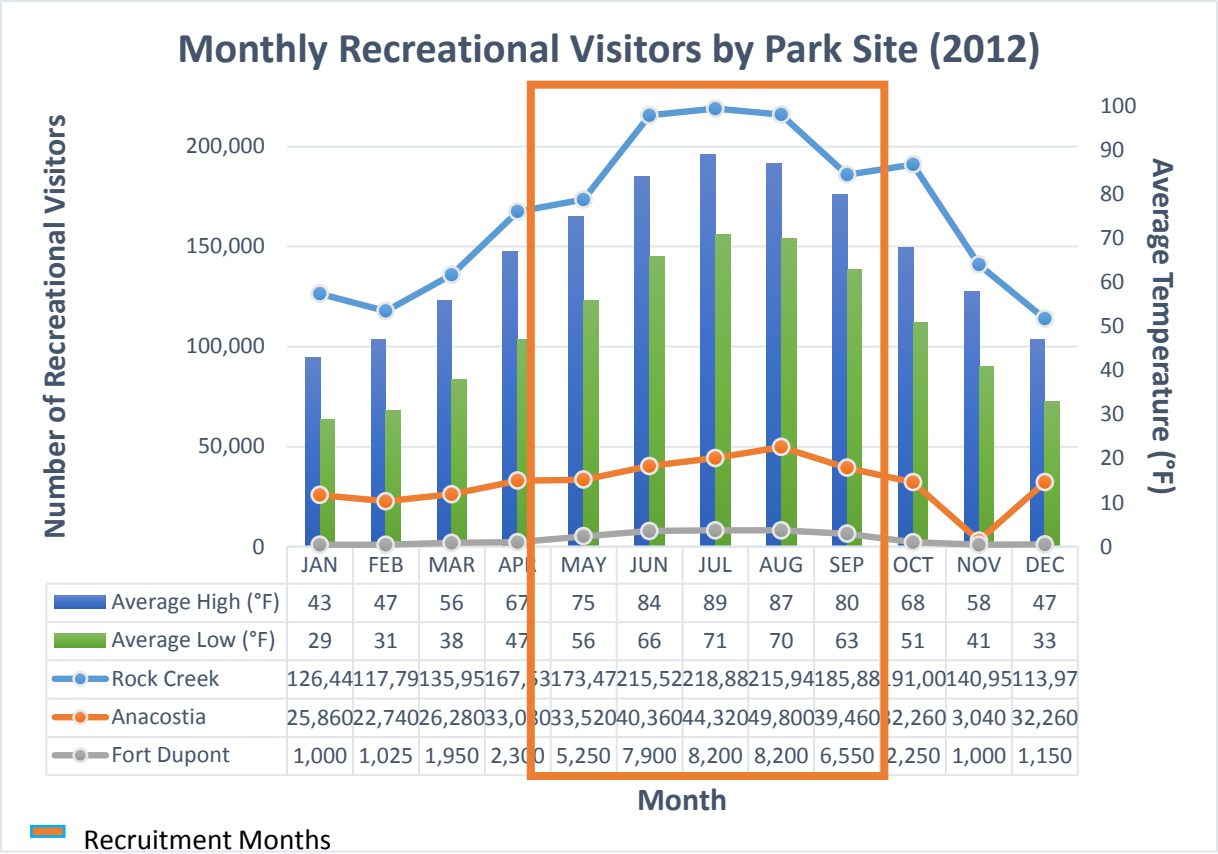

80
• National Park Sites in National Capitol Region with 0.5 mile buffers
Legend
Park Borders
Half-Mile Buffer


13
• National Park Sites within 0.5 miles of a 95% African American census tract
Legend
Park Borders
Half-Mile Buffer
Half-Mile Buffers within 95% AA Census Tracts



Upon making site visits to the remaining four parks and consulting with local staff, it was decided to exclude two additional sites, Fort Davis and Fort Stanton. This was done for three reasons: 1) each have relatively low visitation, 2) even though they are technically separate parks, they are contiguously connected by a trail (the Fort Circle trail) to Fort Dupont and 3) they, along with Fort Dupont, attract similar visitors (demographically and geographically). These factors make the distinction between the three parks (Fort Davis, Fort Stanton and Fort Dupont) artificial. It was therefore decided that Fort Dupont, with its higher visitation rates (Figure 7), would serve as the best recruitment site.

Figure 7: Monthly Recreational Visitors by Park Site (2012)



Finally, to ensure that our sample includes an adequate amount of visitors to allow for subgroup comparisons (primarily White/African American), we included a park site near census tracts with a more heterogeneous racial/ethnic mix. Using 3 demographic maps of census tracts in D.C. created in ArcGIS, we identified the eastern portion of Rock Creek Park as being situated within 0.5 miles of heterogeneous census tracts and meeting our remaining criteria (Figure 8). Darker colors in the demographic layer represent a higher percentage of each respective ethnic/racial group (African American, White, Hispanic) within the total population of each census tract.

Figure 8: Additional Park Recruitment Site Near Heterogeneous Census Tracts

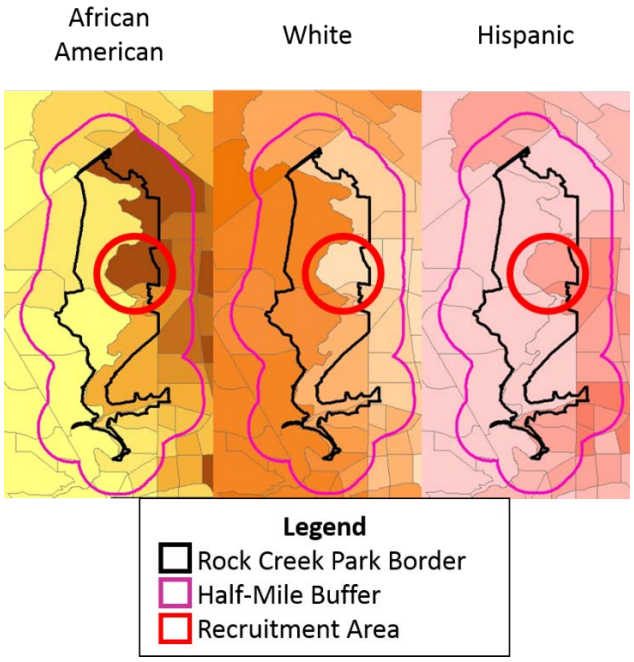


Figure 9 provides a summary of the criteria used to select study recruitment sites, while Figure 10 displays the final three parks selected for our study.

Figure 9: Selection of Study Recruitment Sites

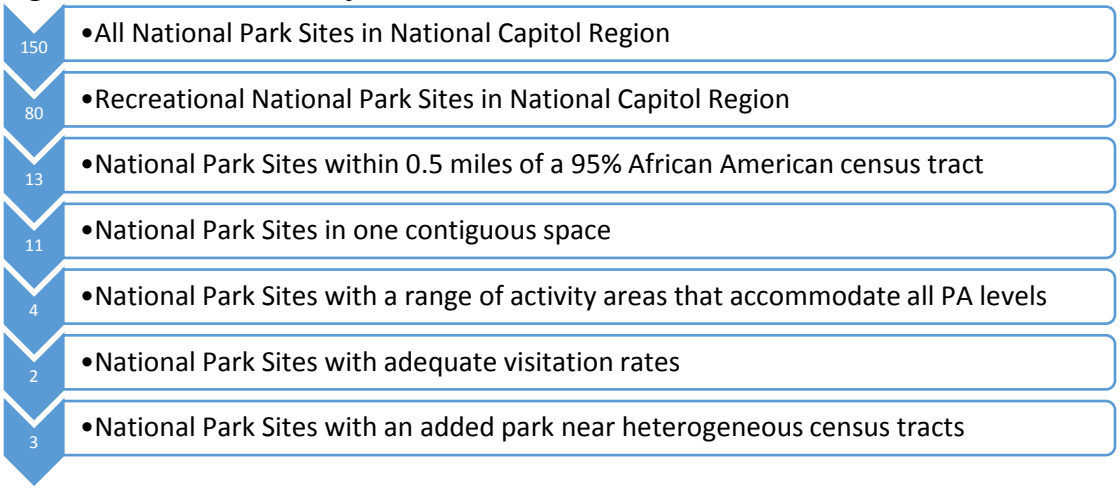
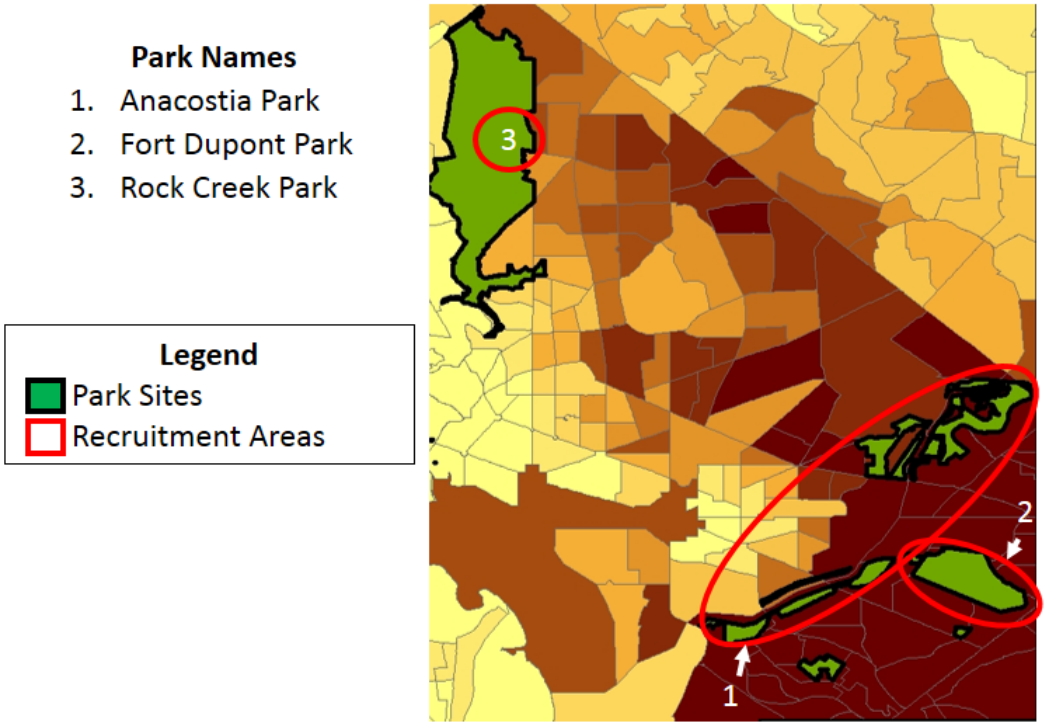


Figure 10: Map of Potential Study Recruitment Sites



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F. ELECTRONIC DATA COLLECTION PROCEDURES

Our study used Open Data Kit (ODK) for our survey data collection, an open source system[4] that employs the use of Android devices (smartphones/tablets) and allows researchers to synchronize data either offline on a computer or through an online cloud server (18). Three Android devices, checked for system reliability by our research team, were utilized.

An electronic survey was created using KoBo Form, a browser-based application developed by a consortium of academic researchers at several universities (62). This particular application (versus other open source options) uses a graphical interface designed for researchers with minimal coding knowledge. Using a password-protected cloud server (App Engine provided by Google), we utilized software called ODK Aggregate to manage and sync our data across multiple Android devices. An Android application called KoboCollect was downloaded onto each device where it connected to ODK Aggregate on our server to download survey forms. The application also displayed our electronic survey on each device, which users can manipulate with their fingers or a capacitive stylus (which was provided if requested). To assist participants in reading our survey, we maximized the font size and brought spare reading glasses.

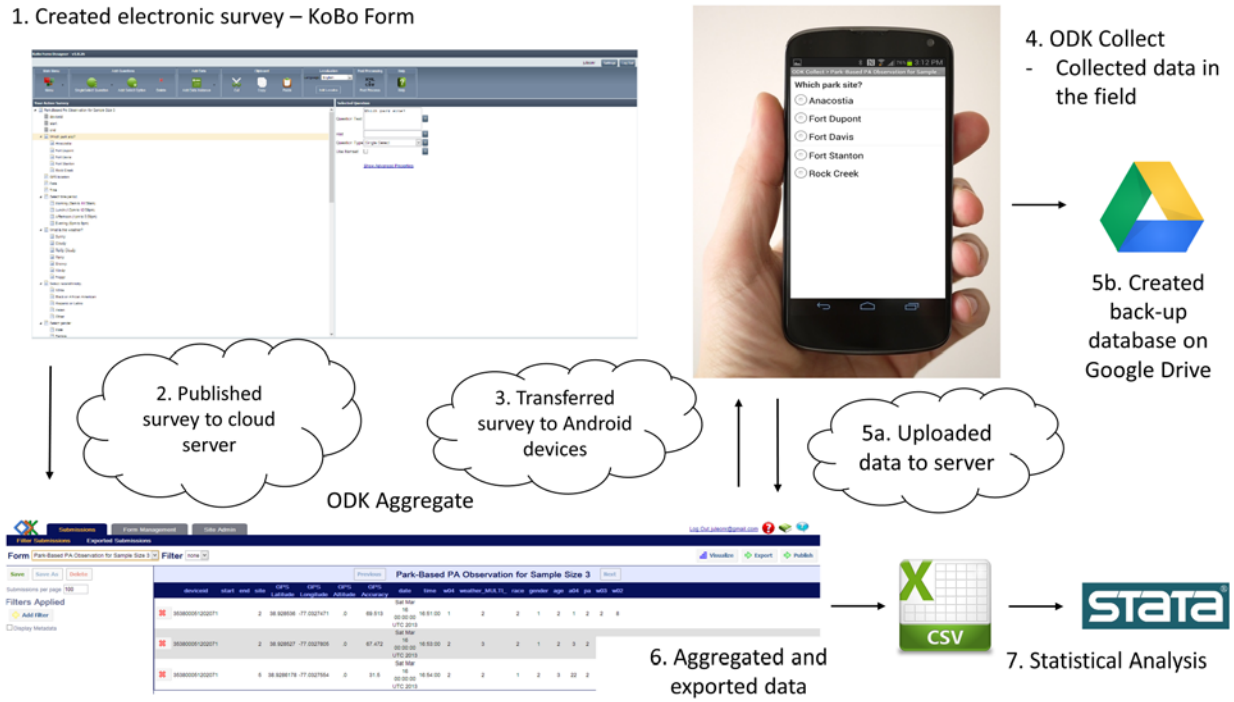
We uploaded our data after each collection period by connecting the devices to a WiFi network. We also manually transferred our data to a password-protected Google Drive account to create an additional backup database.

ODK Aggregate, as its name implies, was used to aggregate our collected data into a CSV file, which is readable by several statistical software packages. This system

[4] Open source software refers to a computer program in which the source code is freely available and requires no license or payment to a company for use.

allowed the principal investigator to continually monitor our incoming data during the collection period in the field. Figure 1 provides a visual overview of these steps.

Figure 11: Overview of Electronic Data Collection



In order to minimize the potential for device theft and maximize the safety of researchers and subjects, the following precautions were taken:

- Data collection only occurred during the day in popular public areas. None of the recruitment sites will be located in secluded or isolated sections within the parks.
- Each device was securely attached to a security lock wire, which was attached to a foldable table.
- NPS Park Police, which regularly patrolled each park, were notified where and when recruitment took place. Data collectors also had emergency numbers, as well as proper permitting documentation (i.e. park research permits, IRB approval), on hand at all times in the field.

Although we did not collect any identifying information from individuals, we took the following steps to secure their survey responses:

- Each device was locked by a password to prevent unauthorized access. Devices were locked using the lock button immediately after a participant was finished with a survey and, as a failsafe, automatically locked after 60 seconds of no user input.
- Data was wirelessly transferred to a secure, password-protected server where only the research team had access. Aggregate output files was kept in a password protected folder on a secured Google Drive account.
- Our data collectors had backup batteries in the field so that data collection activities will not have to be interrupted due to power loss.
- After data was securely transferred and backed up each day, we deleted the electronic survey files on each device (after ensuring back-up copies were properly saved).

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G. Frequencies of Park Activities and Activity Areas

Table 13: Participation in Park Activities (All Parks)

Survey Question:

Please select which of the following activities you did during your visit to [Park Site] today:
Select all that apply.

	Participation		
Activity	**No**	**Yes**	**Total**
Baseball/Softball	1,081	18	1,099
%	98.36	1.64	100
Basketball	1,012	87	1,099
%	92.08	7.92	100
Biking	972	127	1,099
%	88.44	11.56	100
Bird Watching	1,058	41	1,099
%	96.27	3.73	100
Boating (sailing, kayaking, canoeing)	1,097	2	1,099
%	99.82	0.18	100
Fishing	1,086	13	1,099
%	98.82	1.18	100
Flying a Kite	1,095	4	1,099
%	99.64	0.36	100
Football	1,055	44	1,099
%	96	4	100
Frisbee	1,079	20	1,099
%	98.18	1.82	100
Golfing	1,098	1	1,099
%	99.91	0.09	100
Handball	1,096	3	1,099
%	99.73	0.27	100
Hiking	1,007	92	1,099
%	91.63	8.37	100
Horseback Riding	1,097	2	1,099
%	99.82	0.18	100
Laying Down	1,062	37	1,099
%	96.63	3.37	100
Picnicking	1,020	79	1,099
%	92.81	7.19	100

Playing a Board Game	1,088	11	1,099
%	99	1	100
Playing with Kids	962	137	1,099
%	87.53	12.47	100
Reading	1,072	27	1,099
%	97.54	2.46	100
Roller-blading/Roller-skating	1,057	42	1,099
%	96.18	3.82	100
Running /Jogging	855	244	1,099
%	77.8	22.2	100
Sight Seeing	1,012	87	1,099
%	92.08	7.92	100
Sitting	1,007	92	1,099
%	91.63	8.37	100
Skateboarding	1,095	4	1,099
%	99.64	0.36	100
Soccer	1,039	60	1,099
%	94.54	5.46	100
Strength Exercising	1,028	71	1,099
%	93.54	6.46	100
Swimming	1,095	4	1,099
%	99.64	0.36	100
Tennis	1,047	52	1,099
%	95.27	4.73	100
Viewing/Photographing Nature	1,057	42	1,099
%	96.18	3.82	100
Volleyball	1,098	1	1,099
%	99.91	0.09	100
Walking Briskly	815	284	1,099
%	74.16	25.84	100
Walking Leisurely	844	255	1,099
%	76.8	23.2	100
Yoga/Pilates	1,088	11	1,099
%	99	1	100
Other	1,007	92	1,099
%	91.63	8.37	100

Table 14: Activity Areas Visited (All Parks)

Survey Question:

Please tell us where you went during your visit to [Park Site] today:
Select all that apply.

	Participation		
Activity Area	**No**	**Yes**	**Total**
Amphitheater	1,075	24	1,099
%	97.82	2.18	100
Aquatic Gardens	1,090	9	1,099
%	99.18	0.82	100
Baseball/Softball Fields	1,077	22	1,099
%	98	2	100
Basketball Courts	996	103	1,099
%	90.63	9.37	100
Bike Path	892	207	1,099
%	81.16	18.84	100
Boardwalk	1,072	27	1,099
%	97.54	2.46	100
Boat Center	1,092	7	1,099
%	99.36	0.64	100
Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)	994	105	1,099
%	90.45	9.55	100
Exercise Course	1,014	85	1,099
%	92.27	7.73	100
Football Field	1,058	41	1,099
%	96.27	3.73	100
Golf Course	1,090	9	1,099
%	99.18	0.82	100
Handball Courts	1,093	6	1,099
%	99.45	0.55	100
Hiking Trail	920	179	1,099
%	83.71	16.29	100
Historical Sites (for example, a fort, farm or house)	1,071	28	1,099
%	97.45	2.55	100
Horse Trails	1,069	30	1,099
%	97.27	2.73	100
Ice Skating Rink	1,093	6	1,099
%	99.45	0.55	100

Multipurpose Fields (for example, an open grassy area)	992	107	1,099
%	90.26	9.74	100
Nature Center	1,081	18	1,099
%	98.36	1.64	100
Picnic Shelters	953	146	1,099
%	86.72	13.28	100
Playgrounds	999	100	1,099
%	90.9	9.1	100
Recreation/Education Center	1,081	18	1,099
%	98.36	1.64	100
Skating Pavilion	1,007	92	1,099
%	91.63	8.37	100
Soccer Fields	1,032	67	1,099
%	93.9	6.1	100
Swimming Pool	1,089	10	1,099
%	99.09	0.91	100
Tennis Courts	1,027	72	1,099
%	93.45	6.55	100
Track	1,078	21	1,099
%	98.09	1.91	100
Volleyball Courts	1,094	5	1,099
%	99.55	0.45	100
Walking/Running Trails	697	402	1,099
%	63.42	36.58	100
Other	1,062	37	1,099
%	96.63	3.37	100

Table 15: Activity Areas that Would Likely be Used by Participant if Available (All Parks)

Survey Question:

If the following activity areas were available at [Park Site], please check any that you would likely use.
Select all that apply.

	Participation		
Activity Area	**No**	**Yes**	**Total**
Amphitheater	797	302	1,099
%	72.52	27.48	100
Aquatic Gardens	829	270	1,099
%	75.43	24.57	100
Baseball/Softball Fields	931	168	1,099
%	84.71	15.29	100
Basketball Courts	835	264	1,099
%	75.98	24.02	100
Bike Path	585	514	1,099
%	53.23	46.77	100
Boardwalk	866	233	1,099
%	78.8	21.2	100
Boat Center	873	226	1,099
%	79.44	20.56	100
Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)	720	379	1,099
%	65.51	34.49	100
Exercise Course	698	401	1,099
%	63.51	36.49	100
Football Field	939	160	1,099
%	85.44	14.56	100
Golf Course	942	157	1,099
%	85.71	14.29	100
Handball Courts	1,013	86	1,099
%	92.17	7.83	100
Hiking Trail	646	453	1,099
%	58.78	41.22	100
Historical Sites (for example, a fort, farm or house)	811	288	1,099
%	73.79	26.21	100
Horse Trails	915	184	1,099

%	83.26	16.74	100
Ice Skating Rink	892	207	1,099
%	81.16	18.84	100
Multipurpose Fields (for example, an open grassy area)	825	274	1,099
%	75.07	24.93	100
Nature Center	801	298	1,099
%	72.88	27.12	100
Picnic Shelters	692	407	1,099
%	62.97	37.03	100
Playgrounds	806	293	1,099
%	73.34	26.66	100
Recreation/Education Center	857	242	1,099
%	77.98	22.02	100
Skating Pavilion	897	202	1,099
%	81.62	18.38	100
Soccer Fields	909	190	1,099
%	82.71	17.29	100
Swimming Pool	739	360	1,099
%	67.24	32.76	100
Tennis Courts	815	284	1,099
%	74.16	25.84	100
Track	888	211	1,099
%	80.8	19.2	100
Volleyball Courts	956	143	1,099
%	86.99	13.01	100
Walking/Running Trails	584	515	1,099
%	53.14	46.86	100
Other	1,053	46	1,099
%	95.81	4.19	100

Table 16: Knowledge of Activity Areas (All Parks)

Survey Question:

To your knowledge, does [Park Site] have any of the following activity areas? Please check everything that you think it has.

	Participation		
Activity Area	**No**	**Yes**	**Total**
Amphitheater	669	430	1,099
%	60.87	39.13	100
Aquatic Gardens	1,013	86	1,099
%	92.17	7.83	100
Baseball/Softball Fields	594	505	1,099
%	54.05	45.95	100
Basketball Courts	617	482	1,099
%	56.14	43.86	100
Bike Path	268	831	1,099
%	24.39	75.61	100
Boardwalk	967	132	1,099
%	87.99	12.01	100
Boat Center	889	210	1,099
%	80.89	19.11	100
Bodies of Water (for example, rivers, streams, creeks, ponds, lakes)	419	680	1,099
%	38.13	61.87	100
Exercise Course	569	530	1,099
%	51.77	48.23	100
Football Field	817	282	1,099
%	74.34	25.66	100
Golf Course	806	293	1,099
%	73.34	26.66	100
Handball Courts	1,051	48	1,099
%	95.63	4.37	100
Hiking Trail	503	596	1,099
%	45.77	54.23	100
Historical Sites (for example, a fort, farm or house)	700	399	1,099
%	63.69	36.31	100
Horse Trails	689	410	1,099
%	62.69	37.31	100
Ice Skating Rink	1,027	72	1,099

%	93.45	6.55	100
Multipurpose Fields (for example, an open grassy area)	517	582	1,099
%	47.04	52.96	100
Nature Center	674	425	1,099
%	61.33	38.67	100
Picnic Shelters	377	722	1,099
%	34.3	65.7	100
Playgrounds	454	645	1,099
%	41.31	58.69	100
Recreation/Education Center	700	399	1,099
%	63.69	36.31	100
Skating Pavilion	820	279	1,099
%	74.61	25.39	100
Soccer Fields	651	448	1,099
%	59.24	40.76	100
Swimming Pool	837	262	1,099
%	76.16	23.84	100
Tennis Courts	554	545	1,099
%	50.41	49.59	100
Track	972	127	1,099
%	88.44	11.56	100
Volleyball Courts	1,013	86	1,099
%	92.17	7.83	100
Walking/Running Trails	333	766	1,099
%	30.3	69.7	100
Other	1,049	50	1,099
%	95.45	4.55	100

H. The Association of Self-Regulation with Select Variables

- Not coming with partner: high SR (57% vs. 38% with partner; p=0.000)

self_reg	group_comp_partner No	Yes	Total
No Self-Regulation	201 24.54	87 31.41	288 26.28
Moderate Self-Regulat	151 18.44	86 31.05	237 21.62
High Self-Regulation	467 57.02	104 37.55	571 52.10
Total	819 100.00	277 100.00	1,096 100.00

Pearson chi2(2) = 34.0038 Pr = 0.000

- Not coming with other family members: high SR (58% vs. 37% with other family; p=0.000)

self_reg	group_comp_other_fam No	Yes	Total
No Self-Regulation	170 21.44	118 38.94	288 26.28
Moderate Self-Regulat	164 20.68	73 24.09	237 21.62
High Self-Regulation	459 57.88	112 36.96	571 52.10
Total	793 100.00	303 100.00	1,096 100.00

Pearson chi2(2) = 45.1612 Pr = 0.000

- Not coming with children: high SR (60% vs. 32% with children; p=0.000)

self_reg	under_18_yes_no_flip No	Yes	Total
No Self-Regulation	144	139	283
	19.12	42.51	26.20
Moderate Self-Regulat	154	83	237
	20.45	25.38	21.94
High Self-Regulation	455	105	560
	60.42	32.11	51.85
Total	753	327	1,080
	100.00	100.00	100.00

Pearson chi2(2) = 85.3552 Pr = 0.000

- Arriving during early morning hour: high SR (60% vs. 47% in afternoon and 47% in late afternoon/evening; p=0.001)

self_reg	time_arrive_group 5:30am-10	11am-3:59	4pm-8:30p	Total
No Self-Regulation	86	122	75	283
	20.48	30.35	29.76	26.35
Moderate Self-Regulat	82	90	58	230
	19.52	22.39	23.02	21.42
High Self-Regulation	252	190	119	561
	60.00	47.26	47.22	52.23
Total	420	402	252	1,074
	100.00	100.00	100.00	100.00

Pearson chi2(4) = 18.1946 Pr = 0.001

- Lowest income had lower levels of high SR (<$25k: 47%, $25k-$50k: 46%; 50k-75k: 56%, 75k-100k: 58%, 100k-150k: 52%, 150k-200k: 51%, >200k: 52%; p=0.055)

self_reg	What is your annual household income from all sources before taxes? Less than	$25,000-$	$50,000-$	$75,000-$	$100,000-	$150,000-	$200,000	Total
No Self-Regulation	51	49	43	35	39	31	30	278
	37.50	29.34	22.28	26.52	22.54	28.97	22.90	26.76
Moderate Self-Regulat	21	40	41	20	44	21	33	220
	15.44	23.95	21.24	15.15	25.43	19.63	25.19	21.17
High Self-Regulation	64	78	109	77	90	55	68	541
	47.06	46.71	56.48	58.33	52.02	51.40	51.91	52.07
Total	136	167	193	132	173	107	131	1,039
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Pearson chi2(12) = 20.6897 Pr = 0.055